Staff Report No. 163

INTERAGENCY
REPORT ON THE SHELLFISH WATERS
OF NEW HAMPSHIRE

BY

WATER SUPPLY & POLLUTION CONTROL DIVISION
DEPARTMENT OF ENVIRONMENTAL SERVICES

DIVISION OF PUBLIC HEALTH SERVICES
DEPARTMENT OF HEALTH & HUMAN SERVICES

MARINE FISHERIES DIVISION
FISH & GAME DEPARTMENT

FEBRUARY 1989

STATE OF NEW HAMPSHIRE

DEPARTMENT OF ENVIRONMENTAL SERVICES

ALDEN H. HOWARD
COMMISSIONER

GEORGE MOLLINEAUX
ASSISTANT COMMISSIONER

WATER SUPPLY & POLLUTION CONTROL DIVISION

JOHN COLLINS
ACTING DIRECTOR

RUSSELL A. NYLANDER, P.E.
CHIEF ENGINEER

REPORT PREPARED BY:

Richard A. Flanders, Jr.
SUPERVISOR, WATER QUALITY INVESTIGATIONS & MONITORING

FOR

INTERAGENCY SHELLFISH COMMITTEE

Members:

Richard Dipentima, Assistant Director
Division of Public Health Services
Office of Disease Prevention & Control
Department of Health & Human Services

John Nelson, Chief
Marine Fisheries Division
Fish & Game Department

Raymond C. Carter, Administrator
Water Quality, Permits & Compliance Bureau
Water Supply & Pollution Control Division
Department of Environmental Services

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The Committee similarly acknowledges the valued comments and suggestions provided by Thomas Seigle, P.E., Russell A. Nylander, P.E., and Robert Estabrook of the Water Supply & Pollution Control Division of DES.

State of New Hampshire
DEPARTMENT OF ENVIRONMENTAL SERVICES
WATER SUPPLY & POLLUTION CONTROL DIVISION
6 Hazen Drive, P.O. Box 95, Concord, NH 03301
603-271-3504

ALDEN H. HOWARD
COMMISSIONER

RUSSELL A. NYLANDER, P.E.
DEPUTY COMMISSIONER

COUNCIL

March 8, 1989

Mr. Alden H. Howard, Commissioner
Department of Environmental Services
6 Hazen Drive
Concord, NH 03301

Dear Mr. Howard:

Please find enclosed the report entitled "Interagency Report on the Shellfish Waters of New Hampshire". This report was prepared by the Shellfish Committee made up of representatives of Water Supply & Pollution Control Division of DES, the Division of Public Health Services of the Department of Health & Human Services, and the Fisheries Division of Fish & Game Department. As you are aware, the Shellfish Committee was formed as a subcommittee of CORD.

The Shellfish Committee report summarizes the results of several meetings held this spring and summer. Analyses of bacterial contamination in shellfish waters over the past few years is also presented. Recommendations of the Committee and a proposed coliform reduction strategy are presented.

Following review and discussion, the Council agreed at its October 12, 1988 meeting to present this report to you for your review and subsequent transmittal to CORD. This report also reflects comments submitted by a Peer Review panel, made up of representatives of UNH (Dr. Raymond Grizzle of the Jackson Estuarine Laboratory), Water Resources Division (Dr. Frank Richardson), Water Supply Bureau of WS&PCD (Robert Mann, P.E.), and OSP (Stephanie D'Agostino).

Sincerely,

Donald A. Normandeau, Ph.D.
Director, Fish & Game Department

John C. Collins, P.E.
Acting Director, Water Supply
& Pollution Control Division

William T. Wallace, M.D., M.P.H.
Director, Division of Public Health Services
Department of Health & Human Services

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Purpose

While there has been significant improvement in water quality throughout New Hampshire over the last twenty years, there are still several areas of our coastal waters that have been restricted or prohibited from the taking of shellfish (clams, mussels and oysters) due to bacterial counts in excess of the 70 coliform bacteria per 100 milliliters standard for such waters. Major concerns over this situation gave rise to a suggestion by the Water Supply and Pollution Control Council that an interagency Shellfish Committee be established. This Committee, which was subsequently designated by the Council on Resources and Development (CORD) as a subcommittee of that body, consisted of representatives of the Departments of Fish & Game, Health & Human Services, and Environmental Services, and was charged with developing recommendations for a long term solution to the problem of bacteriological contamination of shellfish waters.

Scope

In surveying the possible sources of fecal contamination, the Committee focused its efforts on those areas most likely to result in the best return on capital improvements or resource investment vis-a-vis bacterial reductions and reopened shellfish beds. Due to existing primary treatment facilities discharging to the Cocheco River at Dover and to the Piscataqua River at Portsmouth, the Committee agreed to focus its attention on the Hampton/Seabrook estuary, Rye Harbor, Great Bay and Little Bay. As a result of this decision to limit the scope, this report does not discuss the Dover, Newington, Pease AFB, or Portsmouth wastewater treatment facilities, nor any discharges from the Maine side of the Piscataqua River.

Findings

The basic findings of this study regarding the primary sources of bacteriological contamination are:

1) Wastewater treatment plants do not thoroughly disinfect treated wastewater 100 percent of the time because the chlorination equipment was not designed to meet the increasingly restrictive chlorine residual criterion.

   The primary reason that treatment plants are unable to consistently meet disinfection requirements is a result of opposing demands placed upon chlorination systems. On the one hand, state policy requires that adequate disinfection be imposed to eliminate pathogen discharges from publicly owned treatment works (POTW's). Currently, all coastal communities with wastewater treatment facilities (with the exception of Exeter) utilize chlorine for disinfection. On the other hand, state water quality standards for shellfish waters (and other Class B waters) requires that there be no toxics "in toxic concentrations or combinations." Chlorine is a known toxicant which can kill fish and other aquatic organisms if it is present in toxic amounts. Therefore, the smallest amount possible must be used to kill the harmful bacteria without damaging the fish and aquatic life. While past practice was to raise chlorine residuals in POTW discharges to levels well over two parts per million which readily reduced coliform levels and minimized bacterial contamination of waters overlying shellfish beds, new National Pollutant Discharge Elimination System (NPDES) permits issued by EPA to POTW's are requiring chlorine residuals to be less than 0.5 parts per million to address toxicity concerns. Many existing POTW's are unable to properly disinfect wastewater at these reduced chlorine levels on a consistent basis due to reliance on manual chlorination systems.

2) While communities have intercepted and conveyed to treatment facilities virtually all raw wastewater discharges, there may still be a small number of direct discharges of untreated or inadequately treated wastewater from individual residences, establishments, or seasonal boating.

3) Discharge of combined sewage overflows (CSO) during storm events remains a problem in some communities.

In the past, older cities, rather than constructing separate sanitary sewers and storm drainage systems, built a single sewer system which conveyed both storm water and sewage in a single pipe, called a combined sewer. Unfortunately, combined sewers do not have the capacity to carry all of the storm water during rainstorms, and they periodically overflow into a receiving water. During a rainstorm, the volume of stormwater is many times larger than sewage flows. Further, coliform bacteria associated with the initial flush of stormwater can be as strong as raw wastewater. Therefore, CSO's can be a significant source of coliform during storm events.

4) Nonpoint sources (NPS) of pollution remain to be identified and quantified.

NPS of coliform are any sources which do not emanate from a pipe or channel. For example, farms and urban runoff are likely sources of coliform bacteria during rain events.

Conclusions

Based on the findings in this study, the following conclusions have been made:

1) It should be recognized that due to the characteristics of wastewater and the state of the art for disinfection systems and practices, complete disinfection is not achievable 100% of the time. Thus there are going to be occasions when the coliform standards will be violated, especially when one considers that these standards are more stringent for shellfish waters than for primary contact recreation uses (the standard requires less than 70 coliforms for shellfish waters versus 240 coliforms per 100 ml for Class B "fishable/swimmable" waters).

Recognizing that there might be failures which could result in bacteriological excursions above standards, the Division of Public Health Services of the Department of Health & Human Services intends to define a zone near POTW outfalls where no shellfish may be harvested. In effect, such a prohibition in the designated zone means these areas will remain closed indefinitely for the harvesting of shellfish while allowing for other recreational uses to continue.

2) If publicly owned treatment works (POTW's) fail to adequately disinfect wastewater prior to discharge, high coliform counts may result. At these times, the large volumes of wastewater (with coliforms) relative to other (nonpoint) sources are so great, the POTW's mask the effect of almost all other sources of bacterial contamination. Therefore, as the first phase in addressing the coliform problem in shellfish waters, it is necessary to address the POTW's (point sources) first. As a result, much of the focus of this report is on the design, operation and maintenance of POTW disinfection systems.

3) Correcting the POTW coliform discharge problems may not result in reopening of some shellfish beds due to remaining NPS and CSO problems.

   In essence, there are many sources of coliform other than those associated with treatment plants. Accordingly, addressing only wastewater treatment plants may not remove the restrictions for the taking of shellfish in some areas. Further, some beds which are within designated safety zones around treatment plant outfalls are going to remain closed no matter what action is taken at these treatment facilities.

4) To open the beds, it is essential to address all of the sources of coliform bacteria. This will require detailed knowledge of the various wastewater, NPS and CSO problems in the coastal area.

Recommendations

To achieve the goal of reopening shellfish beds, the following actions should be taken:

1) To increase the effectiveness and efficiency of existing disinfection systems, it is recommended that the communities employ engineering consultants to evaluate and make specific recommendations and cost estimates to ensure the optimal design, operation and maintenance of their disinfection systems. The scope of the investigations should include:

   Assessment of disinfection adequacy (and alternatives to chlorination specifically) in meeting stringent coliform requirements for shellfish waters, in light of chlorine toxicity criteria.

   Where use of chlorine for disinfection is to be continued, the following must be addressed:

   *Automatic dosage of disinfectant based on flow pacing.
   *Continuous chlorine residual analyzers as a feedback control for chlorine dosages.
   *Proper sizing and duplication of all critical chlorination equipment.
   *Dechlorination systems.
   *Additional baffling in the contact tanks, and mixing equipment to improve the efficiency of the disinfection process.

2) Eliminating all the sources of coliform is going to require a substantial investment of time and money. Recognizing that funds, in the final analysis, are limited, it is recommended that after the engineering/cost studies are completed, that a priority list for subsequent action shall be developed which will allow the maximum utilization of available funds.

3) In general, coastal communities must initiate sanitary surveys and take appropriate action to eliminate nonpoint sources of pollution, including failed septic systems, and direct discharges (individual residences, broken sewer pipes, etc.). Federal and state programs that focus on point and nonpoint problems should be tapped where applicable to highlight the importance of protecting these critical near coastal waters.

4) Further study to identify causes and sources of coliform problems in areas with no masking POTW discharges, such as in the Bellamy River, is warranted.

5) Priority should be given to providing state and federal funding to near coastal POTW's under the Construction Grants Program. Some of the funds allocated under Section 604(b) of the Clean Water Act Amendments of 1987 (State Revolving Loan Fund) should be provided to support point and nonpoint programs in the affected communities.

SECTION I
OVERVIEW

Introduction

Increasing public concern over adequate protection of the shellfish waters in New Hampshire prompted the creation of an interagency Shellfish Committee as a subcommittee of the Council on Resources and Development (CORD). The Committee is made up of representatives of the Water Supply & Pollution Control Division of the Department of Environmental Services, the Division of Public Health Services of the Department of Health & Human Services, and the Marine Fisheries Division of the Fish & Game Department. This Committee was charged with collecting available data on potential sources of contamination of shellfish beds in the Hampton Harbor, Rye Harbor, Great Bay, Little Bay and Piscataqua River estuaries. This report summarizes the findings of that Committee and, further, makes specific recommendations for corrective action to restore and maintain the valuable resources there.

Scope

The Shellfish Committee met on March 30 and April 21, 1988 to define the problem, discuss possible causes of the problem, outline possible ways to resolve the problem, and focus on costs of potential solutions. The Committee concensus was that the closure of shellfishing in various estuarine areas was largely a coliform issue. The potential point and nonpoint sources of fecal contamination of human origin were reviewed. It was agreed that the main focus of the Committee efforts would be on Hampton Harbor and the Great Bay estuaries. It was felt that the remaining problems in Rye Harbor were identified and easily resolvable, while outstanding point source problems in the Piscataqua River system (existing primary discharges from Dover and Portsmouth POTW's) did not justify emphasis until these sources were eliminated. Dover is scheduled to be upgraded to secondary treatment by 1990 and Portsmouth's primary plant will be upgraded after 1991 which should greatly reduce coliform levels in this area.

Interagency Responsibilities for Protecting Shellfish Waters

The Water Supply & Pollution Control Division (WS&PCD) of the Department of Environmental Services (DES) is responsible for water quality monitoring to assess conformance with established water quality standards promulgated under legislatively mandated classifications of surface waters. All coastal and near coastal waters in New Hampshire are designated Class B waters, and therefore are expected to meet the following:

> Class B waters shall be of the second highest quality ... and shall be considered as being acceptable for bathing and other recreational purposes... Further, those tidal waters used for growing or taking of shellfish for human consumption shall ... not contain a coliform bacteria count greater than 70 on a Most Probable Number (MPN) basis." (See Appendix I for Water Quality Standards).

The WS&PCD is also obligated to insure that all discharges of municipal and industrial wastes to waters of the state meet certain minimum requirements to protect designated uses. For Class B fresh waters, this means that all point source discharges must provide chlorination or other means of disinfection to reduce coliform bacteria levels to not more than 240 per 100 ml in the receiving water. This requirement is adequate to protect the designated uses of swimming and other primary contact recreational activities. The 70 MPN per 100 ml coliform standard is more restrictive for estuarine waters to further protect human health. Oysters, clams and mussels may concentrate fecal material in their gut due to their filtering action and thereby create a greater health risk when consumed (especially if improperly prepared). Thus the shellfish designated use, superimposed over the "fishable/swimmable" designated use, creates an additional responsibility for wastewater treatment plant operators to maintain adequate coliform reductions while at the same time protecting the receiving waters from chlorine toxicity.

Combined sewer overflows (CSO's) are another point source of bacterial contamination during storm events. Separation of storm and sanitary sewers has been completed in Somersworth but not in Exeter or other coastal towns.

Not all sources of coliforms are from human wastes. Also recognized is the impact of nonpoint, or more diffuse, sources of contamination of shellfish waters. Potential nonpoint sources (nps) include:

Storm Event Related

Urban runoff
Agricultural runoff (animal wastes)

Non-storm Related

Seasonal boat discharges
Inadequate subsurface disposal systems
Waterfowl and domestic fowl

The relative contribution of bacterial contamination from these potential sources is not known and not readily addressable under the scope of this report.

The Division of Public Health Services (DPHS) is responsible for classifying shellfish waters for protection of public health. They are designated "approved" if the median total coliform count for at least twelve samples "does not exceed 70 MPN per 100 ml and not more than 10% of the samples exceed an MPN of 230 per 100 ml" (New Hampshire Rules for Food, He-P 2100, see Appendix II). If the median total coliform count does exceed 70 MPN per 100 ml, then the waters are classed as "restricted" (see He-P 2152.05). Waters exceeding a median total coliform level of 700 MPN per 100 ml are classified as "prohibited" (see He-P 2152.07). The Division is further mandated to insure that "National Program requirements are applied to all actual and potential shellfish growing areas" (emphasis added). The National Shellfish Sanitation Program (NSSP) mandates that DPHS "correctly designates" these shellfish waters in order for the state program to be in compliance. Sanitary surveys, water quality sampling, and other data are collected to implement these programatic requirements. Examples of such documentation are provided in Appendix III and IV.

The New Hampshire Fish & Game Department (F&G) is responsible for

establishing and enforcing rules for the taking of fish and shellfish (FIS 606, see Appendix V). F&G rules only provide for "open" or "closed" waters. "Open" waters are equivalent only to the DPHS "approved" category; all other categories ("restricted", "prohibited" and "unclassified") are considered "closed".

Delineation of Shellfish Waters

Shellfish waters in the Piscataqua River and Coastal basins are delineated in Figures 1 and 2. The Piscataqua River Basin includes Great Bay, Little Bay, Piscataqua River and Little Harbor. The Winnicut, Squamscott, and Lamprey rivers drain to Great Bay. The Oyster and Bellamy rivers drain to Little Bay. The Cocheco and Salmon Falls rivers form the headwaters of the Piscataqua River. The entire estuarine system covers about 11,000 acres of tidal water and about 100 miles of shoreline. While the basin overall is undergoing rapid population growth, only a small portion of the immediately adjoining land area is classified as developed. A large percentage remains as conservation or open space land or is undeveloped land in private ownership (Source: Final Environmental Impact Statement and Draft Management Plan for the Proposed Great Bay National Estuarine Research Reserve, Nov. 1987, NOAA et al.).

The Coastal Basin includes Rye Harbor and the Hampton/Seabrook estuaries. Rye Harbor is very small and receives drainage from a marsh to the north and a small drainage from the south. Hampton Harbor, on the other hand, receives runoff from several rivers and creeks, including the Blackwater River (from Massachusetts); Mill Creek, Hunt's Island Creek, and Browns River from Seabrook; and Hampton Falls River, Taylor River, Tide Mill Creek, and Hampton River from Hampton.

A breakdown of acreage of principal shellfish beds is provided in Table 1, from F&G data.

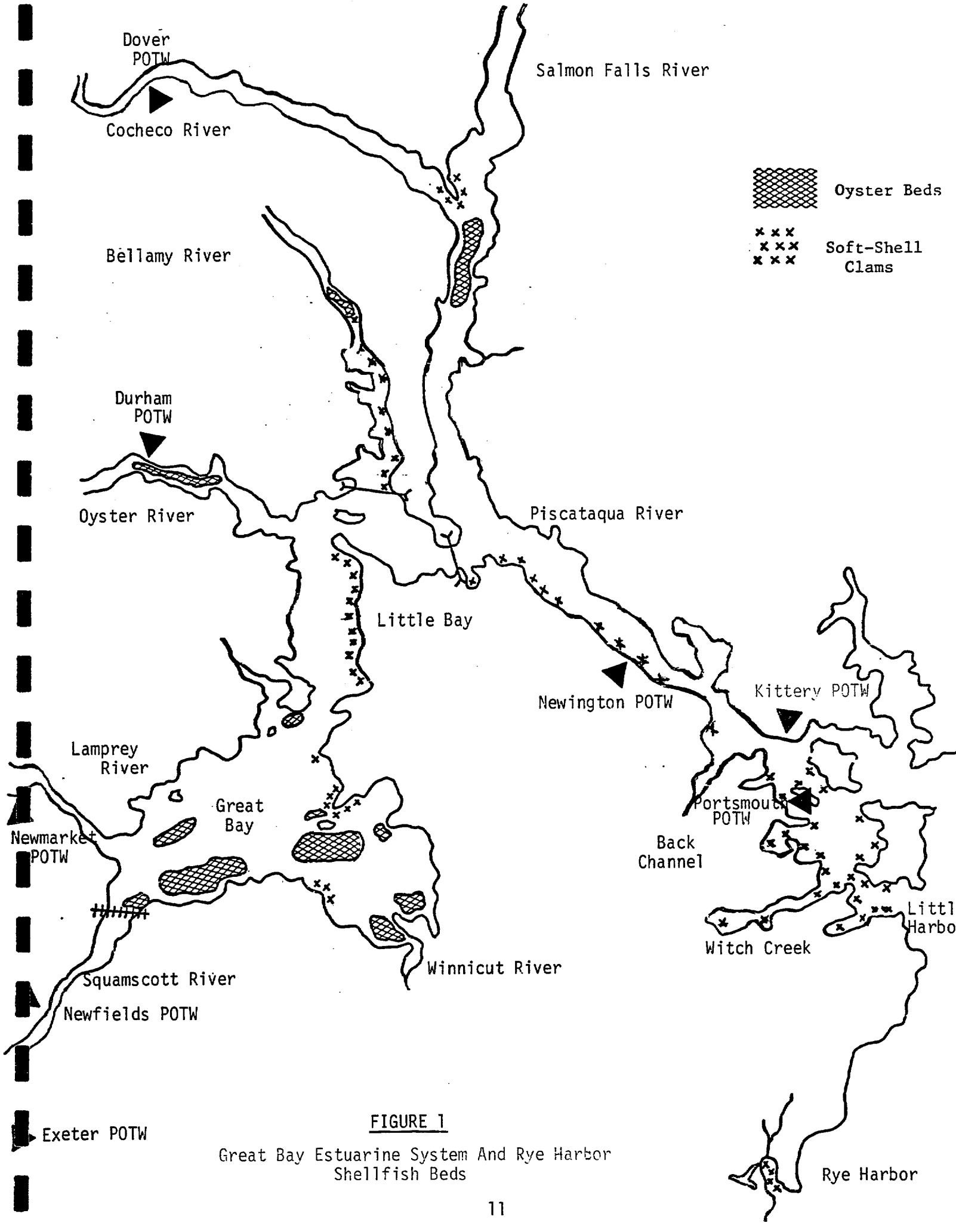

FIGURE 1

Great Bay Estuarine System And Rye Harbor
Shellfish Beds

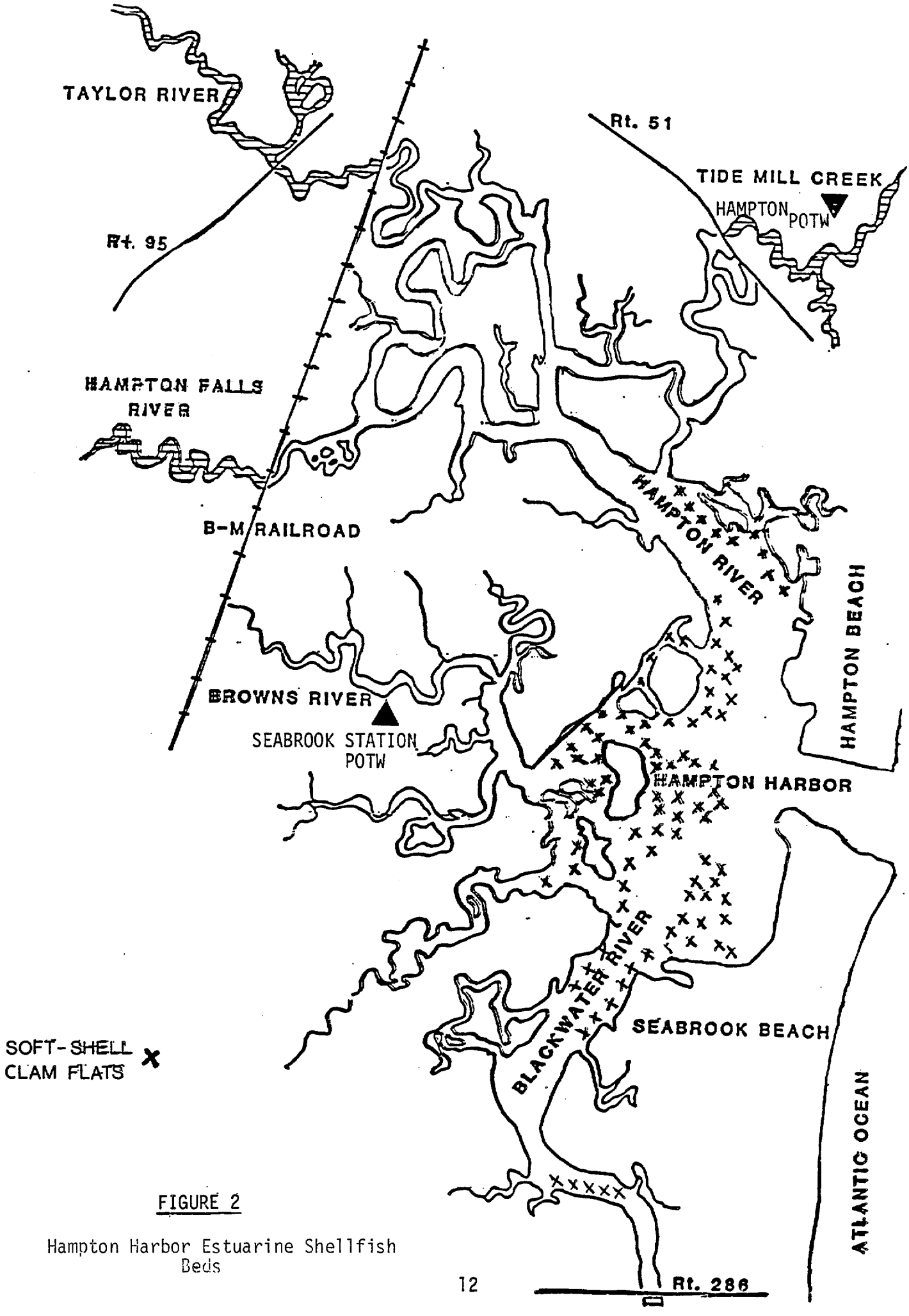

FIGURE 2

Hampton Harbor Estuarine Shellfish Beds

TABLE 1

SHELLFISH IN NEAR COASTAL NEW HAMPSHIRE WATERS

Location	Acres Clam Flats	Oyster Beds
Piscataqua River Basin		
Salmon Falls River	125	-
Cocheco River	140	-
Piscataqua River	265	12.3
Bellamy River	300	3.1
Oyster River	225	7.4
Lamprey River	60	-
Squamscott River	180	-
Little Bay	430	-
Great Bay	1000	9.8
Little Harbor	400	-
Coastal Basin		
Hampton Harbor	162	-
Hampton/Seabrook Rivers	80	-
Rye Harbor	2	-
Nannie Island	-	18.5
Totals	3369	51.1

SECTION II
SHELLFISH PROBLEM AREAS

Based on the results of recent sampling of waters overlying shellfish beds in the various estuarine areas (see Appendix VI), plus observations of surrounding land uses and known pollution sources, an assessment of problem areas was made and is presented below.

Hampton Harbor (See Figure 3)

A - Blackwater River, Salisbury, MA - Suspected source is sewage from residential area West of Rte 1A.

B - Blackwater River, Riverside - Suspected source is sewage from inadequate disposal systems from residential areas.

C - Seabrook Harbor - Suspected source is sewage from area surrounding docks.

D - Tide Mill Creek - Numerous small cottages in the Willows and Eastman Point areas are suspect.

E - Tide Mill Creek - Occasional high coliform counts at the Rte 51 bridge are probably from Hampton POTW upsets.

F - Taylor River - Suspected inadequate disposal of sewage during summer season at yacht club.

G - Taylor and Hampton Falls Rivers - Sampling points at the railroad bridges over both rivers continue to show excessive coliform counts. No obvious source upstream on Taylor River.

H - Hampton Falls River, Weares Mill - High coliform counts were found in the river in this area; further testing may be required.

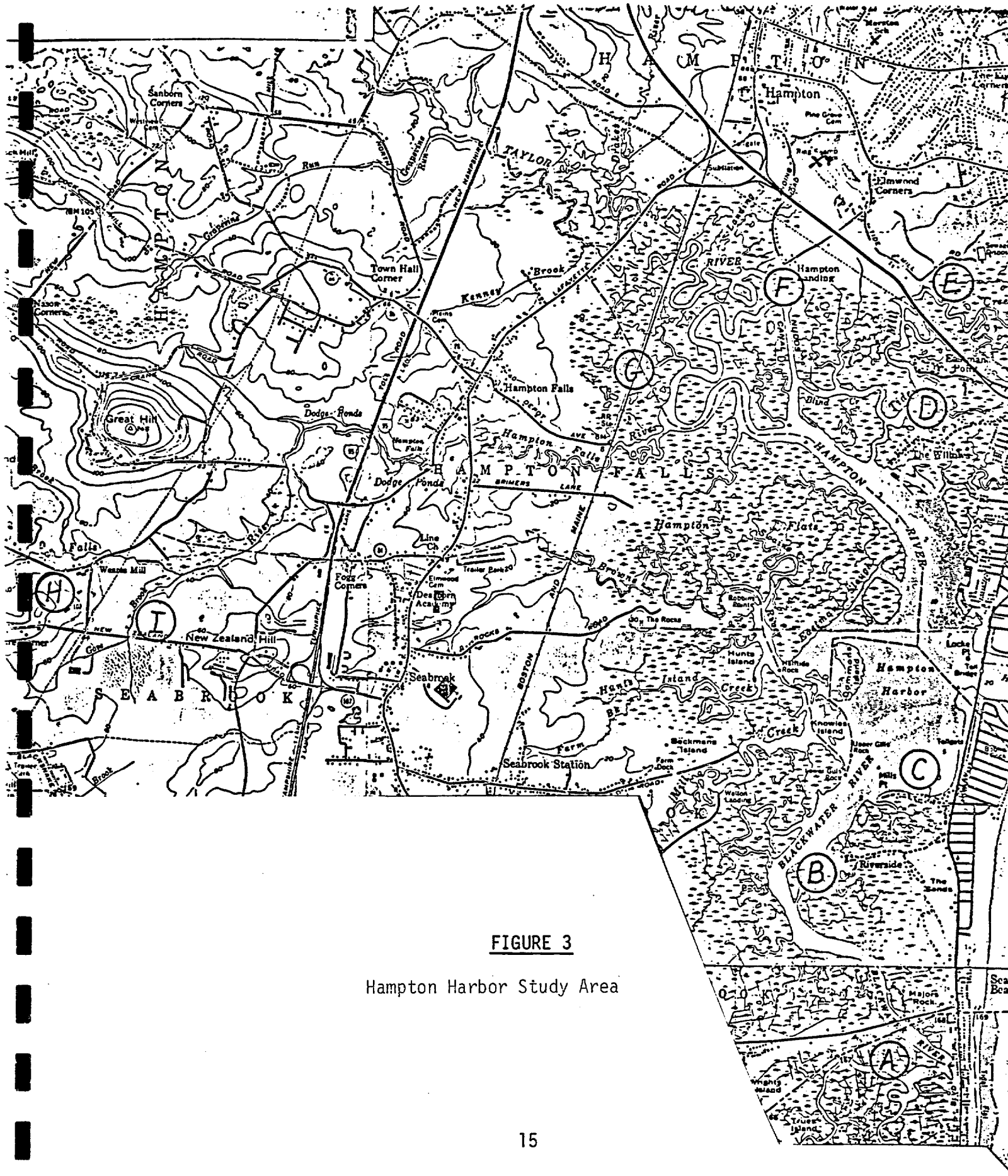

FIGURE 3

Hampton Harbor Study Area

I - Gove Brook - There have been problems in the past with the disposal systems for the apartment complex on New Zealand Hill. Also, there may be a problem with run-off from the dog track area.

Rye Harbor (see Figure 4)

A - Drainage from this area is piped underground, across Cable Road, to the ditch along the NW side of Ocean Blvd. Local officials believe that this is a problem area; however, bacteriological sampling of this drainage as it enters the roadside ditch did not identify any significant coliform bacteria counts (Also see note "B").

B - The drainage ditch along the NW side of Ocean Blvd repeatedly showed high coliform bacteria counts. Local officials blamed drainage from across Cable Road, but testing of that outfall showed that it was not the major source. Drainage from the swampy terrain in the NW quadrant between Ocean Blvd and Cable Road is the logical culprit; several house lots on adjacent side streets slope to this area. It should be noted that the flow entering from the culvert under Ocean Blvd, draining the area to the east, was found to be clean.

C - The branch of the tidal stream which enters from the west and drains the area SW of Locke Road, also showed significant coliform bacteria counts. The only source for this appears to be from the residences along Locke Road.

D - Previously identified pollution from the tidal stream crossing under Ocean Blvd has been presumed to be the cause of the elevated coliform bacteria counts found at the Harbor Road bridge. However, local residents point to the Pilot House Restaurant as a possible additional source of contamination.

E - Testing of the area to the SW of Harbor Road and the seashore side of Ocean Blvd eliminated this area as a source of pollution.

F - Discharge from rest rooms at Ray's Restaurant was confirmed as a source of pollution to Awcomin Marsh. New holding tanks at Ray's eliminated this pollution. However, continued surveillance of this facility and review

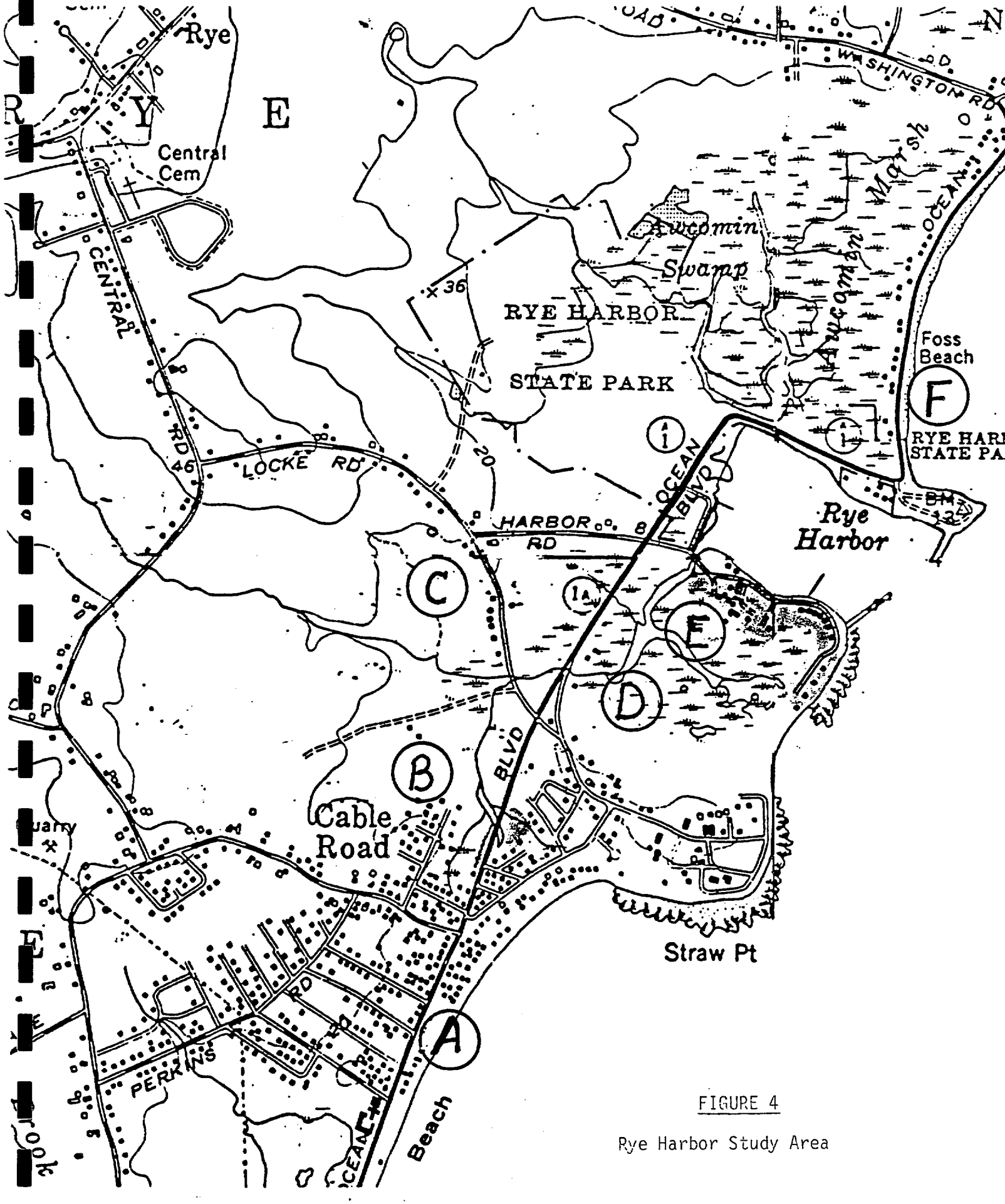

FIGURE 4

Rye Harbor Study Area

of pump-out logs is recommended to assure that this discharge does not resume.

Summary - Inasmuch as most of the problems in the Rye Harbor area are, or appear to be, related to historical straight-pipes or inadequate disposal systems, the overall density and use of the area does not warrant extending the sewer system. Investigations and sanitary surveys by local officials should be encouraged.

Piscataqua River (see Figure 5)

This river, from its origin at the confluence of the Cocheco and Salmon Falls rivers, to the ocean, has historically been closed to shellfish harvesting. The combined effect of the Dover POTW discharge to the Cocheco, several New Hampshire and Maine POTW discharges to the Salmon Falls, and the Portsmouth discharges downstream, result in significantly high coliform counts during all tidal cycles. No improvement is anticipated until these sources are abated. For Dover, it is anticipated that secondary treatment will be achieved in 1990; for Portsmouth, an upgrade should be initiated by 1991.

Great Bay (see Figure 5)

The conditions of the waters within the Great Bay area (including Little Bay) are determined primarily by the individual estuaries flowing into the bay. Incoming tidal flows from the Piscataqua River, plus flow from the Oyster River, produce unacceptable levels of coliform bacteria throughout most of Little Bay.

The problems on the Oyster River stem primarily from an unreliable chlorination system at the Durham POTW. Other possible non-point sources in this watershed cannot be adequately assessed while this overwhelming effect continues.

Recent upgradings and new construction to the Dover sewer system should have eliminated all discharges to the Bellamy River; however, coliform counts continue to be above acceptable limits for shellfish harvesting. Surveys by the Division of Public Health are underway to attempt to identify the

FIGURE 5

Great Bay Estuarine System Study Areas

source(s) of this pollution.

The Lamprey River has historically been grossly polluted by the discharge from the Newmarket POTW. Recent upgrading of that facility, and solution of problems related with start-up, have made significant improvement in the overall water quality of the river. Moonlight Brook, a small stream which flows through and under downtown Newmarket, shows evidence of significant sewage pollution. It is recommended that the town officials identify and eliminate this problem.

Unchlorinated effluent from the Exeter POTW lagoons continues to add significant coliform pollution to the Squamscott River. Plans to install disinfection at those lagoons should upgrade the water quality of the Squamscott to acceptable limits. The Newfields POTW, which also discharges to this river, has had no problem maintaining an effluent that is within permit limits.

Little Harbor (Figure 6)

The waters of Back Bay, between Portsmouth and Newcastle, continue to be seriously degraded by the discharge of the primary effluent from the Portsmouth POTW. Several known or suspected outfalls from shorefront buildings add to this problem.

There continue to be reports of raw sewage odors in the vicinity of Mike's Marina and BG's Restaurant on Sagamore Creek. No source has been located but moderate coliform counts in this area support the existence of some sewage discharge to the creek.

Little Harbor, although considered acceptable at this time, occasionally has tested unacceptable. This has been attributed to intermittent variations in the flows from Back Bay. Concerns for Little Harbor include the new major marina complex at Wentworth-by-the-Sea. The marina includes a pump-out facility for boat holding tanks but does not routinely pump out its members vessels. However, while many boats in the current Portsmouth area have proper holding tanks, most owners are suspected of discharging sewage either directly or indirectly overboard. Theoretically, the discharge of wastes is only

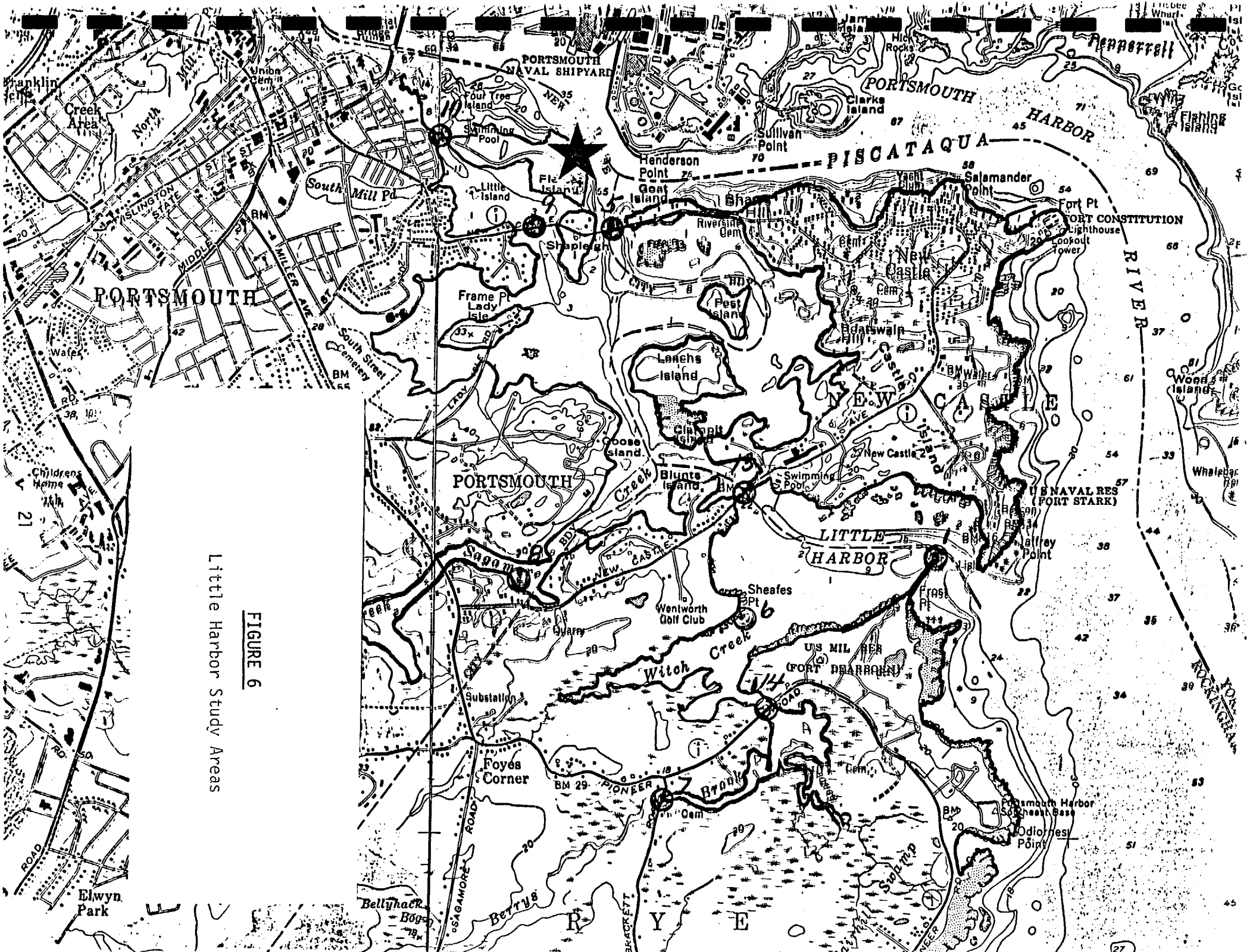

FIGURE 6

Little Harbor Study Areas

allowed outside the 3-mile limit. Stringent controls of overboard discharges by the marina operator are needed. However, designation of a restricted shellfish zone around the marina will likely be necessary. Although there has been a presumed summer weekend problem in Little Harbor from the large number of occupied boats there overnight, no special weekend testing has been performed.

SECTION III
WASTEWATER TREATMENT FACILITIES

A survey of all publicly owned treatment facilities that discharge to shellfish waters was completed by the Operations Section of WS&PCD in May 1988. Due to the concern over disinfection capabilities versus elevated coliform counts as measured in their discharges, the survey focused on plant equipment capabilities and possible improvements.

The following is a synopsis of the publicly owned treatment works (POTW) that discharge into sensitive shellfish estuarine waters.

Hampton-Seabrook Estuary

Hampton POTW -Activated sludge system.

Design Flow - 4.7 million gallons per day (MGD) (year 2000).

Existing Flow - 1.8-3.0 MGD, seasonal, peaks during summer. High acceptance of septage from the seacoast area.

General Condition - Secondary portion of the facility is twelve years old. Original plant was built in the 1930's. Antiquated solids handling equipment was recently replaced. More improvements are presently under design (anaerobic sludge digesters) and some under construction (headworks and septage receiving).

Disinfection Equipment - Sodium hypochlorite is introduced into effluent by diaphragm pumps. However chlorine contact tanks are not overly conducive to plug flow; thus dead spots and some short circuiting may be a potential problem. They are presently upgrading their chlorination system by replacing one of two oversized hypochlorite metering pumps with a new 0-70 gallon per hour pump. Within several months the facility will be installing a new 4-20 m flow transmitter to pace the new hypochlorite pump.

Possible Improvements - Although monitoring reports show only two coliform violations over the past five months, the disinfection system may be improved by baffle alterations in the contact tank and the installation of backup chlorine dosing equipment that is also paced off

effluent flow and/or residual concentrations. This facility's permit requires a maximum chlorine residual of 0.5 mg/l which appears inadequate for proper disinfection. Therefore, it appears that a dechlorination system may be in order.

Seabrook (Proposed)

Although no municipal treatment facility presently exists in Seabrook, one is planned for construction in 1990 and is presently under design. The discharge from this facility should not impact shellfish areas as it will be directed into the ocean, not the Seabrook estuary. There may be some water quality impact due to inadequate subsurface disposal systems outside the proposed service area.

Seabrook Station (PSNH) - Aerated lagoon system.

Design Flow - 0.05 MGD

Present Flow - 0.010 MGD

General Condition - Generally good effluent quality. Lagoons are followed by filtration and disinfection.

Disinfection System - Hypochlorite addition, long contact time given flow. Facility has chlorine analyzer. However, occasional discharge permit violations occur during changes of season and with algal interference.

Possible Improvements - Increased backwashing of filter is recommended. Dye testing of contact tank was performed and improvements to the tank were undertaken resulting in consistent compliance subsequent to alterations.

General Comment - Coliform contamination of Brown's River may occur from other sources at Seabrook Station such as runoff from the site, under drainage, etc. This treatment facility is generally in compliance with NPDES permit limits.

Rye Harbor

At present there are no point discharges from any POTW into Rye Harbor, nor are any planned. The state run beach at Wallis Sands has a system consisting of septic tanks followed by underdrained sand filters with effluent disinfected by hypochlorite and discharged off-shore into the ocean. Likewise, the proposed discharge from the Rye wastewater treatment plant will be into the open ocean. Neither of these discharges will affect water quality in Rye Harbor directly.

Squamscott River and Great Bay - Facilities will be discussed from upstream down toward Great Bay.

Exeter Stormwater Lagoons

Design Flow - None has ever been determined for this facility. These ten acre stabilization ponds accept all extraneous combined wastewater flow that is not pumped to the POTW lagoons.

Present Flow -- Acting essentially as stabilization ponds, somewhat treated combined wastewater and stormwater is discharged as necessary to control water level in the ponds.

Disinfection Equipment - Effluent is discharged through 1000 gpm pumps after adequate disinfection. The present system utilizes new sodium hypochlorite metering pumps and the old chlorine contact tanks of the former Clemson industrial treatment plant located adjacent to the ponds. A new contact tank is proposed to be built when the old Clemson facility is razed.

Possible Improvements - This system appears to function well and the discharge is carefully monitored and controlled so that adequate disinfection consistently occurs. However, a tide clock controlled discharge is recommended such that only outgoing tides receive the lagoon discharge.

Exeter POTW -Aerated lagoons for sanitary wastes.

Design Flow - 2.61 MGD

Existing Flow -1.0 - 2.0 MGD (as high as 3.5 MGD during storm events).

General Conditions - This system, formerly stabilization ponds, has been upgraded with mechanical aeration in order to provide secondary treatment for a portion of the town's wastewater flow. There are 16.9 acres of aerated lagoon and 7.8 acres of stabilization ponds. One former pond is now off-line due to its utilization as a sludge repository when the remaining ponds were cleaned. Although improvements have been made to this system, it remains inadequate for present and future loadings and is occasionally out of permit compliance. A major upgrading is presently under design and should result in a facility that will adequately serve for years to come.

Disinfection System - At present none exists. However, at the time of facility upgrading chlorination will be added. The system now under design consists of hypochlorite disinfection followed by dechlorination and appears to be adequate.

Newfields POTW - Aerated lagoon. On line in 1983.

Design Flow - 0.117 MGD

Existing Flow -0.006 MGD (influent) which may peak to 0.2 MGD when discharging under operator control. The NPDES permit calls for discharge on the outgoing tide.

General Condition - This facility is underloaded and has long detention times and good treatment. The automatic tide clock designed to control discharge on the outgoing tide (Squamscott River) has never worked properly.

Disinfection System - Disinfection with hypochlorite occurs only when discharging. The rate of effluent flow can be precisely regulated by the operator as can the chlorination rate. This assures good process control and accurate dosing. Solution pumps, which are 0.06 to 1.5 gph, can be paced off the effluent flowmeter. Less than optimum contact tank design; at present flow, chlorine contact time is more than adequate to

assure disinfection.

Possible Improvements - With four NPDES coliform violations in the past fifteen months, there is a need to assess contact tank baffle configuration to assure effective kill over varying flow conditions.

Lamprey River and Great Bay

Newmarket POTW - trickling filter

Design Flow - 0.85 MGD

Existing Flow - 0.4 MGD (wet weather flow = 0.8 MGD)

General Conditions - This facility was recently upgraded to secondary. The original primary plant was constructed in 1972. This facility lacks adequate sludge dewatering equipment. This may affect effluent quality in the near future and impact on the plant's capability to properly disinfect due to solids carryover.

Disinfection System - This facility uses gaseous chlorination which is flow paced. The chlorine contact tanks do not lend themselves to consistently effective disinfection, although based on facility monitoring reports, no NPDES coliform violations have occurred during the past year. Nevertheless, high coliform counts have been observed in the Lamprey River. Recent sampling indicates that this may be due to raw waste discharged into surface waters in the town of Newmarket, in particular into Moonlight Brook. It is recommended that a detailed sanitary survey be performed by the local health officer in order to locate the source of high coliform levels and to eliminate the problem.

Possible Improvements - The original design of the contact tank makes it difficult to improve; however greater effectiveness in disinfection can be achieved by baffling modification or better mixing. It is strongly recommended that adequate solids handling, dewatering and disposal equipment be installed. The NPDES permit should be revised to lower allowable coliform levels to 70 MPN per 100 ml after improvements are made. Further, the facility should consider dechlorination.

Oyster River and Little Bay

Durham POTW - Activated sludge.

Design Flow - 2.5 MGD

Existing Flow - 1.0 - 1.5 MGD (seasonal flow variations due to University of New Hampshire students in rental housing, occasionally up to 3.0 MGD)

General Condition - Original primary plant constructed in 1970, last upgraded in 1980. This facility utilizes composting as a sludge stabilization technique. However, difficult solids transfer under winter conditions slows composting so a backlog of solids in the activated sludge system occurs. This may affect effluent quality and therefore disinfection capabilities. Flow splitting into secondary clarifiers is inaccurate, leading to imbalanced hydraulics.

Disinfection System - Presently this facility is using one of three oversized hypochlorite metering pumps. This equipment is quite corroded, as are the pump controls. Although the system was originally designed to be flow paced, this is currently not in working order. As a result chlorination is manually adjusted for flow in the morning and evening. Also, chlorine contact tanks are of adequate size but baffling design is not optimum. Over the past fifteen months there have been five total coliform violations according to self-monitoring reports. However the results of testing the Oyster River for shellfish protection indicate a more frequent violation rate.

Possible Improvements - This facility should install two new accurately sized hypochlorite metering pumps that are properly flow paced. A flow splitter box should be constructed to eliminate hydraulic imbalance of the mixed liquor being introduced to the secondary clarifiers. Such a device has been designed by the town's engineer under the last construction grant but was not built. Some minor improvements should be made to the contact tanks to reduce the potential for short circuiting.

SECTION IV

RECOMMENDATIONS AND PROPOSED STRATEGY

Recommendations

The following recommendations are made as a result of the Shellfish Committee findings:

1) Towns with POTW's that discharge to shellfish waters should contract with engineering consultants for a study of the effectiveness of their disinfection system. Assessment of disinfection adequacy (and alternatives to chlorination specifically) in meeting stringent coliform requirements for shellfish waters, in light of toxic criteria, should be the focus of the study.
   It is recommended that the following be included for those facilities that choose to continue use of chlorine for disinfection:

   a) All POTW's (perhaps with the exception of lagoons) should utilize flow paced control of chlorine dosage to insure more consistent disinfection. Continuous chlorine residual analyzers should be installed as a feedback control for chlorine dosage.

   b) All POTW's should provide duplication of critical chlorination equipment, such as chlorine feed pumps, to provide a backup capability. Additionally, alarm systems for disinfection system failure should be installed at all POTW's.

   c) Where chlorination continues to be used, dechlorination of treated effluents should be required.

   d) Dye studies should be performed on chlorine contact tanks so that mixing and contact patterns may be defined. This may lead to the utilization of low cost alterations such as additional baffling or mixing equipment that would render disinfection systems more efficient.

e) Studies should be performed at key POTW's to determine if a correlation exists between chlorine dosage and total coliform counts in the effluent as related to total suspended solids and chlorine residual.

f) Since solids removal is a critical element in effective disinfection of POTW effluents, improved solids handling and removal capability must be provided at all facilities.

2) In addition, the communities should initiate the following:

a) Sanitary surveys should be performed at certain sensitive areas where pollution sources are responsible for high coliform counts, particularly in Rye Harbor drainages, Newmarket and Durham.

b) Nonpoint pollution sources should be investigated near shellfish areas to assess their relative contribution to coliform standard violations. Such potential sources include urban runoff, failed septic systems, and overboard head and galley discharges from boats.

c) A notification system should be established by each facility in the event of disinfection failure. The Division of Public Health, Department of Environment Services, and the Fish & Game Department should be notified immediately of any potential contamination of shellfishing areas.

3) It is recommended that further studies be undertaken to identify the causes and sources of coliform bacteria problems is areas with no masking POTW discharges, such as in the Bellamy River watershed. Funding sources may be available under the National Estuary Program.

4) Priority should be given to providing state and federal funding to near coastal POTW's under the Construction Grants Program. Some of the funds allocated under Section 604(b) of the Clean Water Act Amendments of 1987 (State Revolving Loan Fund) should be provided to support point and nonpoint programs in the affected communities.

Since the elimination of all sources of coliform bacteria contamination will require tens of millions of dollars, critical information is necessary before a program can be initiated. For example, information is lacking on the relative contribution of bacteria from point versus nonpoint sources. Federal and state programs that focus on point and nonpoint problems may be available and should be tapped where applicable. Therefore, it is recommended that a cost/benefit analysis be done which outlines the relative cost of remediation versus the benefits derived (shellfish value, other resource values, etc.) for both point and nonpoint controls. A consultant should be hired, possibly under the National Estuary Program, to initiate this analysis.

Proposed Coliform Reduction Strategy

It is the consensus of the members of the Shellfish Committee that given limited resources, point sources of potential fecal contamination be the initial focus in the state's overall coliform reduction strategy. Nonpoint sources of contamination shall be a subsequent emphasis in terms of resource committment.

In terms of priorities, the following actions are recommended:

1. Communities should locate and eliminate the few remaining raw discharges to estuarine waters.

2. Communities should have their consultants review disinfection facilities at existing POTW's to improve their efficiency.

3. Prohibition on the taking of shellfish in closed safety zones to be defined by the Division of Public Health Services around POTW discharges.

4. Communities should require individuals with inadequate on-site subsurface disposal systems to upgrade them or provide connections to existing sanitary sewers.

5. Prohibition of discharges from boats, while in estuarine or harbor waters, must be strictly enforced.

While the above items are addressed, a study should be done to assess other sources of contamination. Specifically:

1. Urban runoff during storm events must receive careful attention and attenuation methodologies developed to mitigate impact on shellfish waters.

2. Combined sanitary and storm sewer overflows should be located and the feasibility and cost of separation studied to eliminate combined sewer overflows during storm events.

SECTION V
SUMMARY AND CONCLUSIONS

Summary

A survey of the significant POTW's currently discharging to shellfish waters in New Hampshire has disclosed a number of equipment limitations that may result in inadequate control over disinfection of treated wastewater effluents. Sanitary surveys and water quality monitoring performed jointly by the Division of Public Health Services of the Department of Health & Human Services and the Water Supply & Pollution Control Division of the Department of Environmental Services has documented periodic violations of the coliform standard for shellfish waters near POTW discharges and other areas. The Fish & Game Department's regular bans on the harvesting of shellfish in contaminated estuarine waters has been highlighted by the media and focused attention on existing point sources as the most probable source of fecal contamination. Potential nonpoint sources of contamination were also identified; however, and include failing on-site subsurface disposal systems, urban and agricultural runoff, combined sewers, boat discharges and waterfowl.

In addition, recommendations focused on abating nonpoint source concerns are offered. Lastly, a coliform reduction strategy is proposed to realistically focus on priorities and limited resources with the overall goal of providing consistent protection of valuable shellfish waters and the health of estuarine organisms.

Conclusions

The Shellfish Committee finds that while a significant investment has been made over the last twenty years in building wastewater treatment facilities to provide treatment of human organic loads, the existing POTW disinfection equipment will not continuously achieve the stringent bacteriological limitations required to protect the shellfish areas. It should be recognized that POTW's do have disinfection systems which can inject adequate doses of disinfectant to meet the coliform limitations. In essence, when the POTW's were built, they were designed to provide sufficient disinfection to achieve complete coliform reduction. Unfortunately, recent

research has shown that large doses of chlorine are toxic to aquatic life resulting in a tightening of chlorine effluent requirements. Accordingly, the existing POTW's are attempting to fine tune chlorine dosage which the original equipment was never designed to accomodate. Therefore, specific recommendations were made to improve disinfection systems.

Based on staff investigations, the Committee proposes a bacterial reduction strategy that focuses initially on upgrading existing POTW's treatment and disinfection capabilities, and secondarily, on other nonpoint sources of pollution to attain designated use standards for shellfish waters.

APPENDIX I

WATER QUALITY CLASSIFICATIONS AND STANDARDS

APPENDIX I

CHAPTER 149

149:3 Standards for Classification of Surface Waters of the State. For purposes of classification there shall be four classes or grades of surface waters as follows:

I. Class A waters shall be of the highest quality and shall contain not more than fifty coliform bacteria per one hundred milliliters. There shall be no discharge of any sewage or wastes into waters of this classification. The waters of this classification shall be considered as being potentially acceptable for water supply uses after disinfection.

II. Class B* waters shall be of the second highest quality and shall have no objectionable physical characterictics, shall be near saturation for dissolved oxygen, and shall contain not more than two hundred forty coliform bacteria per one hundred milliliters. There shall be no disposal of sewage or waste into said waters except those which have received adequate treatment to prevent the lowering of the physical, chemical or bacteriological characteristics below those given above, nor shall such disposal of sewage or waste be inimical to fish life or to the maintenance of fish life in said receiving waters. The pH range for said waters shall be 6.5 to 8.0 except when due to natural causes. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water shall not be such as to appreciably interfere with the uses assigned to this class. The waters of this classification shall be considered as being acceptable for bathing and other recreational purposes and, after adequate treatment, for use as water supplies. 1963, 26:2. 1967, 147:4

III. Class C waters shall be of the third highest quality and shall be free from slick, odors, turbidity, and surface-floating solids of unreasonable kind or quantity, shall contain not less than five parts per million of dissolved oxygen; shall have a hydrogen ion concentration within the range of pH 6.0 to 8.5 except when due to natural causes; and shall be free from chemicals and other materials and conditions inimical to fish life or the maintenance of fish life. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water shall not be such as to appreciably interfere with the uses assigned to this class. The waters of this classification shall be considered as being acceptable for recreational boating, fishing, or for industrial water supply uses either with or without treatment depending upon individual requirements. 1967, 147:5

IV. Class D waters shall be the lowest classification and shall be free from slick, sludge deposits, odors, and surface-floating materials of unreasonable kind, quantity or duration, taking into consideration the necessities of the industries involved, and shall contain not less than two parts per million of dissolved oxygen at all times. Any stream temperature increase associated with the discharge of treated sewage, waste or cooling water shall result in a receiving water temperature not in excess of 90°F. The waters of this classification shall be aesthetically acceptable. Such water shall also be suitable for certain industrial purposes, power and navigation. 1967, 147:6

*Chapter 147:15, Laws of 1967, provides that: All surface waters of the state heretofore or hereafter classified as Class B-1 or Class B-2 waters are hereby reclassified as Class B waters.

IV-a. Notwithstanding anything contained in this chapter to the contrary, the commission in submitting classifications relating to interstate waters to the New England Interstate Water Pollution Control Commission for review and approval, as provided for under the terms of Article V of the compact whereby the interstate commission was created by RSA 488, shall submit such classifications in accordance with the standards of water quality as currently adopted by said interstate water pollution control commission provided, however, that the standards for any classification thus submitted for review and approval shall not be less than, nor exceed the standards of the classification duly adopted by the General Court as provided for in RSA 149:6 or 7. 1969, 337:2

IV-b. Tidal waters utilized for swimming purposes shall satisfy all conditions contained in paragraph II above. Those tidal waters used for growing or taking of shellfish for human consumption shall, in addition to the foregoing requirements not contain a coliform bacteria count greater than seventy on an MPN basis. 1969, 337:2

IV-c. Notwithstanding anything contained in this chapter to the contrary, the commission shall have the authority to adopt such stream classification criteria as may be issued from time to time by the Federal Environmental Protection Agency or its successor agency insofar as said criteria may relate to the water uses specified in RSA 149:3, I, II, and III. Provided, however, that the criteria thus issued shall not result in standards that are less than nor exceed the standards of the classification duly enacted by the general court as provided for in RSA 149:6 or 7. 1973, 590:3

V. All tests and sampling for the purpose of examination of waters shall be performed and carried out in a reasonable manner and whenever practicable, in accordance with the current edition of the Standard Methods for Examination of Water and Sewage as published jointly by the American Public Health Association and the American Water Works Association. Near saturation for dissolved oxygen shall mean a dissolved oxygen content at least seventy-five percentum of saturation. The waters in each classification shall satisfy all the provisions of all lower classifications. The minimum treatment for the lowest classification shall be as follows:

(a) For sewage, primary treatment and disinfection resulting in substantially complete disinfection and removal of all settleable and floatable materials. 1963, 47:1. 1967, 147:7

(b) For industrial wastes, such treatment, not to exceed primary treatment or its equivalent, as the commission shall determine after due consideration of the provisions of paragraph IV above. Appeal from any such determination shall be in the manner provided for in section 14 thereof. 1963, 47:1. 1967, 147:7

V-a. In prescribing minimum treatment provisions for thermal wastes discharged to interstate waters, the commission shall adhere to the water quality requirements and recommendations of the New Hampshire fish and game department, the New England Interstate Water Pollution Control Commission, or the National Technical Advisory Committee of the Department of the Interior, whichever requirements and recommendations provide the most effective level of thermal pollution control. 1969, 337:3

VI. Subject to the provisions of RSA 149:8, III, the fish and game department may use rotenone or similar compounds in the conduct of its program to reclaim the public waters of the state for game fishing. 1955, 82:1. 1973, 590:4

Part 430. Water Quality Standards—Criteria [Reserved]

Part 431. Water Quality Standards—Purpose and Definitions

HISTORY

Statutory Authority: RSA 149:3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 431.01 Purpose. The purpose of these rules is to establish criteria for the protection of surface water uses as set forth in RSA 149:3, I, II, and III. The criteria shall be used as the basis for decisions regarding the protection of surface water quality.

Ws 431.02 Part Definitions.

(a) "Antidegradation policy" shall mean a policy which protects the current high water quality use even though water may be classified for a lesser use.

(b) "Coliform organisms" means any of a number of organisms whose presence in water is a possible indication of potentially dangerous bacterial contamination emanating from human and animal wastes.

(c) "Disinfection" means the killing of the larger portion, but not necessarily all, of the harmful and objectionable microorganisms in, or on, a medium by means of chemicals, heat, ultraviolet light, etc.

(d) "Dissolved oxygen (DO)" is the oxygen dissolved as a gas in sewage, water or other liquid usually expressed in milligrams per liter (mg/l), per million (ppm) or percent saturation.

(e) "pH" is the index of hydrogen ion activity used as an indication of acidity or alkalinity in water.

(f) "Pollutant" means any introduced gas, solid, or liquid matter which renders a resource unfit for a specific use.

(g) "Surface waters of the state" means streams, lakes, ponds and tidal waters within the jurisdiction of the state, including all streams, lakes, or ponds bordering on the state, marshes, watercourses, and other bodies of water, natural or artificial.

(h) "Sewage" means the water carried waste products from buildings, public or private, together with such groundwater infiltration and surface water as may be present.

(i) "Temperature" is a measure of heat content.

(j) "Toxic materials" means any liquid, gaseous, or solid substance which alone or in combination with other substances in sufficient concentration may exert a poisonous effect detrimental to man, fish or other aquatic life.

(k) "Warm water fish" are fish, such as bass, sunfish, catfish, and suckers, which inhabit warmer waters.

(*l*) "Cold water fish" are fish, such as salmon, trout, whitefish, smelts, and shad, which normally inhabit colder waters.

(m) "Waste" means industrial waste and other wastes.

(n) "Industrial waste" means any liquid, gaseous or solid waste substances, resulting from any process of industry, manufacturing, trade or business, or from development of any natural resources.

(*o*) "Other wastes" means garbage, municipal refuse, decayed wood, sawdust, shavings, bark, lime, ashes, offal, oil, tar, chemicals, and other substances harmful to human, animal, fish or aquatic life.

Part 432. Water Quality Standards—Standards

HISTORY

Statutory Authority: RSA 149:3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 432.01 Description of Classifications. Descriptions of Class A, Class B, and Class C uses, as well as criteria associated with coliform bacteria, pH, slicks, odors, and surface floating solids, appear in RSA 149:3, I, II and III.

Ws 432.02 Dissolved Oxygen. The dissolved oxygen criteria for Class A and B waters is not less than 75 percent of saturation nor less than 6 parts per million (ppm) in cold water fisheries, unless naturally occurring. The criteria for Class C waters is not less than 5 ppm in warm water fisheries nor less than 6 ppm in cold water fisheries, unless naturally occurring.

Ws 432.03 Substances Potentially Toxic. The standard for Class A waters is none, unless naturally occurring; for Classes B and C, none in toxic concentrations or combinations. Toxic concentrations and combinations are evaluated in accordance with EPA's published water quality criteria for 64 toxic substances dated November 1980.

Ws 432.04 Sludge Deposits. The criteria for Class A is none; for Classes B and C, no unreasonable kinds or quantity, unless naturally occurring.

Ws 432.05 Oil and Grease. The Class A standard for oil and grease is none. The standards for Class B and C are no unreasonable kinds or quantities.

Ws 432.06 Color. The color standard for Class A is none in unreasonable quantities, unless naturally occurring. The standards for Class B and C for color are none in unreasonable quantities, unless naturally occurring.

Ws 432.07 Turbidity. In Class A waters, the standard is none exceeding 5 standard turbidity units, unless naturally occurring. For Class B and C waters, the standard is none exceeding 10 standard turbidity units in cold water fisheries nor 25 standard turbidity units in warm water fisheries, unless naturally occurring.

Ws 432.08 Slicks, Odors, and Surface Floating Solids. In Class A waters, the standard is no slicks, odors, or surface floating solids, unless naturally occurring. For Class B and C, the standard is no slicks, odors or surface floating solids in unreasonable kinds or quantities or duration, unless naturally occurring.

Ws 432.09 Temperature. The standard for Class A water is no artificial rise in temperature. For Class B and C waters, the standard is no artificial temperature rise exceeding that recommended by the New Hampshire fish and game department, the New England interstate water pollution control commission, or the National Technical Advisory Committee, Department of the Interior, whichever is most appropriate for the existing situation.

Ws 432.10 Phosphorus.

(a) The standard for Class A water is no phosphorus, unless naturally occurring. For Class B and C waters, the phosphorus

standard is none in such concentrations that would impair any usages assigned to the Class, unless naturally occurring.

(b) In Class A, B and C streams and saline waters, there shall be no phosphorus in such concentrations that would impair any usage assigned to the specific class involved. Where treatment to remove phosphorus is required under this rule, such treatment shall remove phosphorus to the extent feasible.

(c) There shall be no new point discharge of water containing phosphorus to lakes or ponds. In addition, there shall be no new discharge of wastewater containing phosphorus to tributaries of lakes or ponds that would encourage eutrophication or growth of weeds or algae in such lakes and ponds.

(d) Any point discharge of wastewater existing as of the effective date of these rules, and containing phosphorus in concentrations which encourage eutrophication or growth of weeds or algae, shall be treated to remove such phosphorus to the maximum extent feasible.

Ws 432.11 Gross Beta Radioactivity. For all classes the standard of gross beta radioactivity shall not exceed 1000 picocuries per liter.

Ws 432.12 Strontium-90. For all classes the standard is no strontium-90 in excess of 10 picocuries per liter.

Ws 432.13 Radium-226. For all classes the standard is none in excess of 3 picocuries per liter.

Ws 432.14 Phenol. The standard for Class A and B waters is no phenol in excess of .001 ppm. The standard for Class C water is .002 ppm.

Ws 432.15 pH. The standard for Class A waters is as naturally occurs.

Ws 432.16 Other Standards. In addition to the preceding criteria, the commission is guided by the 1976 EPA publication, "Quality Criteria for Water".

Part 433. Water Quality Standards—Flow Standards

HISTORY

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 433.01 Low Flow. The water quality standards appearing in RSA 149: 3, I, II, and III and in Part 432 shall apply at all times except during periods when receiving stream flows are less than the minimum average seven day flow which occurs once in 10 years (7 Q 10).

Ws 433.02 Controlled Flow Policy. It is the policy of the New Hampshire water supply and pollution control commission to cooperate with appropriate federal, state and private interests in the development and maintenance of stream flow requirements for the purpose of achieving the assigned water quality classification in regulated streams.

Part 434. Water Quality Standards—Sample Collection and Analyses

HISTORY

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 434.01 Standard Methods. All methods of sample collection, preservation, handling, and analysis shall conform to one or more of those published in the following references:

(a) "Standard Methods For The Examination Of Water And Wastewaters," 15th edition, 1981, Public Health Association, New York.

(b) "American Society For Testing And Materials", part 23, "Water; Atmospheric Analysis," 1976, American Society For Testing and Materials.

(c) "Methods For Chemical Analysis of Water and Wastes," 1979, U.S. Environmental Protection Agency (EPA).

(d) "Microbiological Methods for Monitoring the Environment—Water and Wastes," 1978, U.S. Environmental Protection Agency.

(e) Such other methods as EPA may prescribe.

Part 435. Water Quality Standards—Bioassay Procedures

HISTORY

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 435.01 Limits. When establishing limits on toxic substances for the protection of aquatic life, "Appendix B—Guidelines for Deriving Water Quality Criteria for the Protection of Aquatic Life and Its Uses," CFR Vol. 45, No. 231, November 28, 1980, will be utilized. Bioassay procedures and analysis shall be consistent with "Methods for Measuring Acute Toxicity of Effluents (third edition)" published by EPA, or equivalent protocol as approved by the commission.

Part 436. Water Quality Standards—Mixing Zones

HISTORY

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 436.01 Mixing Zones. The commission may consider mixing zones, except as otherwise provided in these rules or by statute; and where mixing zones are allowed, they shall conform to the "Quality Criteria for Water" published by the Environmental Protection Agency (1976), or the requirements of the commission which shall be no less restrictive than existing federal requirements.

Part 437. Water Quality Standards—Fish Life

History

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 437.01 Cold Water Fisheries. All surface waters of New Hampshire shall be deemed suitable for cold water fisheries unless otherwise designated by the New Hampshire fish and game department.

Ws 437.02 Protection From Chemicals. Notwithstanding anything contained in Part 432, all surface waters of the state shall be free from chemicals and other materials and conditions inimical to fish life or to maintenance of fish life.

Part 438. Water Quality Standards—Natural Causes

HISTORY

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 438.01 Applicability. The preceding criteria in Parts 433 through 437 shall not apply to any condition resulting from natural causes.

Part 439. Water Quality Standards—Antidegradation Policy

HISTORY

Statutory Authority: RSA 149: 3.

Source and Effective Date for Rules: The rules in this part were adopted effective May 15, 1984 (document #2707). Earlier adoption dates and subsequent amendments affecting particular rules appear in source notes following the text of the affected rule.

Expiration Date for Rules: For listing of expiration dates, see Table of Expiration Dates of Rules.

Ws 439.01 Beneficial Uses. In all cases, existing in-stream beneficial water uses shall be maintained and protected. Any actions that would become injurious to existing uses shall not be undertaken. Waste assimilation and transport are not recognized beneficial uses.

Ws 439.02 Existing High Quality. Existing high quality waters shall be maintained at their existing high quality unless the commission decides to allow limited degradation where economically or socially justified. If limited degradation is allowed, it shall not result in violation of water quality criteria that describe the base levels necessary to sustain the state and federal water quality goal of propagation of fish, shellfish, wildlife, and recreation in and on the water.

Ws 439.03 Maintenance of State or National Resources. In all cases, high quality water which constitutes an outstanding state or national resource shall be maintained and protected.

Ws 439.04 Thermal Discharge. Any determinations concerning thermal discharge limitations under section 316(a) of the Federal Water Pollution Control Act, as added by Public Law 92–500, section 2, shall be considered in compliance with the antidegradation policy.

HISTORY

References in text. Section 316 of the Federal Water Pollution Control Act, referred to in this rule, is classified to 33 U.S.C. § 1326.

Revision note. Substituted "the Federal Water Pollution Control Act, as added by Public Law 92–500, section 2" for "Public Law 95–217" to correct an error in the reference.

APPENDIX II

NEW HAMPSHIRE RULES FOR FOOD

PART He-P 2103 SANITATION OF THE HARVESTING AND PROCESSING OF SHELLFISH/BOTTLED WATER

He-P 2103.01 Definitions

(a) "Approved area" means an area which has been approved by the Division of Public Health Services for growing and/or harvesting of shellfish for direct marketing.

(b) "Area growing" means an area in which market shellfish are grown.

(c) "Approved source" when used in reference to a plant's water product or water used in the plant's operations means the source(s) of the water and the water therefrom, whether it be from spring, artesian well, drilled well, municipal water supply, or any other source which has been inspected by Water Supply and Pollution Control Commission and after analysis found to be of a safe and sanitary quality.

(d) "Artesian Well Water" means water from a well tapping an aquifer in which the water level will stand above the bottom of the confining bed of the aquifer, and in which the hydraulic pressure of the water in the aquifer is greater than the force of gravity."Artesian Well Water" also meets the requirements of "Natural Water".

(e) "Bottled water" means water that is sealed in a container or packaged and is offered for sale for human consumption or other consumer uses.

(f) "Coliform group" means all of the aerobic and facultative anaerobic, gram-negative, non-spore forming bacilli which ferment lactose with gas formation within 48 hours at 35° C. Bacteria of this group which will produce gas from E.C. medium within 24 hours at 44.5° C in a water bath will be referred to a fecal coliforms.

(g) "Controlled purification" means the process of removing contamination from whole live shellfish acquired while growing in polluted areas.

(h) "Demineralized water" means water which has been demineralized by distillation, deionization, reverse osmosis, or other methods and contains not more than 10 parts per million (ppm) total solids.

(i) "Depletion" means the removal of all market-size shellfish from an area.

(j) "Director" means the director, Division of Public Health Services or his agent.

(k) "Distilled Water" means water which has been produced by a process of distillation and meets the definition of purified water.

(l) "Division" means the Division of Public Health Services, Department of Health and Welfare.

(m) "Drinking water" means water obtained from an approved source and has undergone any of the processes described in these rules or has undergone minimum treatment consisting of filtration (activated carbon and/or particulate) and ozonation or equivalent disinfection process.

(n) "Dry storage" means the storage of shell-stock out of water.

(o) "Food-product zone" means the parts of food equipment, including auxiliary equipment which may be in contact with the food being processed, or which may drain into the portion of equipment with which food is in contact.

(p) "Internal temperature" means the actual temperature of shucked shellfish in the container, as opposed to the air temperature of the refrigerator in which the shellfish may be stored.

(q) "Lot" means a collection of primary containers or unit packages of the same, type, and style produced under conditions as nearly uniform as possible and designated by a common container code or marking.

(r) "Mineral water" means water that is impregnated with mineral solids and has been obtained entirely from an approved source and contains not less than 500 parts per million (ppm) of dissolved mineral solids.

(s) "Most probable number (abbreviated MPN)" means the statistical estimate of the number of bacteria per unit volume, and is determined from the number of positive results in a series of fermentation tubes.

(t) "Multiservice containers" means containers intended for use more than one time.

(u) "National shellfish sanitation program" means the cooperative State-Public Health Service-Industry program for the certification of interstate shellfish shippers as described in Public Health Service Publication Number 33, National Shellfish Sanitation Program Manual of Operations, Parts I and II.

(v) "Natural water" means ground water that is not modified in its mineral content by addition or subtraction, may have undergone only minimum treatment consisting of filtration (activated carbon and/or particulate) and ozonation or equivalent disinfection process.

(w) "Nontoxic materials" means material for product water contact surfaces utilized in the transporting, processing, storing, and packaging of bottled drinking water, which are free of substances which may render the water injurious to health or which may adversely affect the flavor, color, odor, or bacteriological quality of the water.

(x) "Operations water" means water which is delivered under pressure to a plant for container washing, hand washing, plant and equipment cleanup and for other sanitary purposes.

(y) "Person" means an individual or firm, partnership, company, corporation, trustee, association, or any public or private entity.

(z) "Population equivalent (coliform)" means the quantity of sewage containing approximately 160×10^9 coliform group bacteria.

(aa) "Primary container" means the immediate container in which product water is packaged.

(ab) "Principal display panel" means that part of a label designed to be most likely displayed, presented, shown, or examined under normal and customary conditions of display and purchase.

(ac) "Product water" means processed water used by a plant for bottled drinking water.

(ad) "Purified water" means water producted by distillation, deionization, or reverse osmosis.

(ae) "Reshippers" mean shippers who transship shucked stock in original continers, or shell-stock, from certified shellfish shippers to other dealers or to final consumers.

(af) "Repackers" means shippers, other than the original shucker, who pack shucked shellfish into containers for delivery to the consumer.

(ag) "Sanitary survey" means the evaluation of all factors having a bearing on the sanitary quality of a shellfish growing area including sources of pollution, the effects of wind, tides, and currents in the distribution and dilution of the polluting materials, and the bacteriological quality of the water.

(ah) "Shellfish" means all edible species of oysters, clams, or mussels, wether shucked or in the shell, fresh or frozen.

(ai) "Shellfish, market" means shellfish which are, may be or have been harvested and/or prepared for sale for human consumption as a fresh or frozen product.

(aj) "Shell-stock" means shellfish which remain in their shells.

(ak) "Shell-stock shippers" means shippers who grow, harvest, buy, and/or sell shell-stock, but are not authorized to shuck shellfish.

(al) "Shipping cases" means a container in which one or more primary containers of the product are held.

(am) "Shucked shellfish" means shellfish, or parts thereof, which have been removed from their shells.

(an) "Shucker-packers" means shippers who shuck and pack shellfish.

(ao) "Single-service container" means a container intended for one time usage only.

(ap) "Spring water" means water that is taken from a natural orifice in the ground or collected from the natural orifice and transported by pipes, tunnels, or similar devices; and also means spring water obtained from a natural orifice or from a bore hole adjacent to the natural orifice.

(aq) "Transplanting" means the moving of shellfish from one area to another area.

(ar) "Unit package" means a standard commercial package of bottled drinking water, which may consist of one or more containers.

(as) "Well water" means water from a hole bored, drilled, or otherwise constructed in the ground, which taps the water of an aquifer and meets the requirements of "Natural Water".

(at) "Wet storage" means the temporary storage of shellfish from approved sources, intended for marketing, in tanks containing sea water or in natural bodies of water, and including storage in floats.

He-P 2103.02 Reserved

PART He-P 2150 SANITATION OF SHELLFISH GROWING AREAS - GENERAL ADMINISTRATIVE PROCEDURES.

He-P 2150.01 Reserved.

He-P 2150.02 Procedures for Compatibility in the Requirements of the National Shellfish Sanitation Program (NSSP)

The Division shall insure that:

(a) National Program requirements are applied to all actual and potential shellfish growing areas.

(b) National Program requirements are applied to all commercial market shellfish harvesters.

(c) National Program requirements are applied to all persons handling the shellfish prior to its delivery to the interstate shipper.

(d) Interstate shellfish shipper certificates are issued only to those establishments substantially meeting the construction requirements of He-P 2160 through 2164 and which maintain a plant sanitation rating of at least 80 percent during periods of operations. Ratings shall be determined on the basis of compliance with the applicable provisions of He-P 2160 through 2164.

(e) The following records are kept of shellfish sanitation activities as required in He-P 2152 through 2154:

(1) Individual growing area files. (Areas may be defined by either geographic or political boundaries.)

(2) Plant inspections. Shucker-packers and repackers shall be inspected at least quarterly. Shell stock shippers and reshippers shall be inspected at a frequency which will afford adequate public-health supervision of their operations. A central inspection-report file shall be maintained by the Division.

(f) Following rules are observed in issuing interstate shellfish certificates.

(1) Certificate content. Each certificate shall give the following information:

a. Name. (The usual business name and alternative names that shall appear on the interstate shellfish shippers list, hereafter called "list.")

b. Address. (A business and/or mailing address. This address indicates where records are kept and where inspection may be arranged.)

c. Certificate Number. (A number shall be assigned for each business unit. Suffix or prefix letters shall not be used to differentiate between two or more plants of a given shipper.)

d. Classification. (The shipper classification shall be indicated by a symbol: i.e., shucker-packer, SP; repacker, RP; shell stock, SS; or reshipper, RS. Only one classification shall be used. The single classification shall cover all proposed operations which the shipper is qualified to perform.)

e. Expiration Date. (All certificates shall expire on the same date, preferably the last day of a month. This date shall be shown on the "list". All certificates shall be automatically withdrawn from the "list" on the date of expiration unless new certificates have been received by U.S. Public Health Service headquarters office. If the date of expiration coincides with the date of issue for the "list" the certificates expiring on the date of issue shall be deleted.)

f. Certifying Officer. (Each certificate shall be signed.)

(2) Certificate changes. A change in an existing, unexpired certificate shall be made by issuing a corrected certificate.

(3) Interstate shipment before listing. The shipper shall be informed of the probable date his name will appear on the "list" and shall be advised against making interstate shipment prior to that date. (If shipments must be made before the appearance of the shipper's name on the "list", the U.S. Public Health Service notifies the

applicable receiving States if the names and addresses of the expected receivers are indicated in advance by the Program when the certificate is forwarded to the U.S. Public Health Service.)

(4) Cancellation, revocation, or suspension of interstate shipper certificates. If the Division revokes, cancels, or suspends an interstate shellfish shipper certificate, the U.S. Public Health Service regional office shall be immediately notified, by telephone or telegram, with a following confirmatory letter.

(5) Mailing list for interstate shellfish shipper list. Names of persons, business units, organizations, or agencies, desiring copies of the "list", and requests for information concerning the "list" shall be sent to the appropriate U.S. Public Health Service regional office. Recipients will be circularized periodically to determine if they still have use for the "list".

(g) The appropriate U.S. Public Health Service regional office shall be notified by the Division of any revision in growing area classification. The notification shall so describe the area that it may be readily located on Coast and Geodetic Survey charts.

(h) Division shellfish plant inspectors shall be provided with the following inspection equipment: standardized inspection forms, thermometer, chlorine test kit, and light meter.

(i) Interdepartmental memoranda of understanding shall be developed which shall define the responsibilities of each State agency in maintaining adequate sanitary control of the shellfish industry.

He-P 2150.03 Intrastate Sale of Market Shellfish.--Sanitary standards for intrastate shellfish shippers shall be the same as those of the National Shellfish Sanitation Program.

PART He-P 2152 SANITATION OF SHELLFISH GROWING AREAS--GROWING AREA SURVEY AND CLASSIFICATION.

He-P 2152.01 Sanitary Surveys of Growing Areas.

(a) A sanitary survey shall be made of each growing area prior to initial approval of interstate shipments of shellfish from that area. A comprehensive sanitary survey shall include an evaluation of all sources of actual or potential pollution on the estuary and its tributaries, and the distance of such sources from the growing areas; effectiveness and reliability of sewage treatment works; the presence of industrial wastes, pesticides, or radionuclides which would cause a public-health hazard to the consumer of the shellfish; and the effect of wind, stream flow, and tidal currents in distributing polluting materials over the growing area.

(b) The factors influencing the sanitary quality of each approved shellfish growing area shall be reappraised at least biennially. A complete resurvey shall be made of each growing area in a approved category at least once every five years; however, data from original surveys may be used when it is clear that such information is still valid.

(c) A file which contains all pertinent sanitary survey information, including the dates and results of preceding sanitary surveys shall be maintained by the Division for each classified shellfish area.

(d) The Division shall develop a system for identification of growing area.

He-P 2152.02 Classification of Growing Areas.

(a) All actual and potential growing waters shall be correctly designated with one of the following classifications on the basis of sanitary survey information: Approved; conditionally approved; restricted; or prohibited.

(b) Area classifications shall be revised whenever warranted by survey data.

(c) Classifications shall not be revised upward without at least a file review, and there is a written record of such review in the area file maintained by the Division.

He-P 2152.03 Approved Areas. An area shall be classified as "approved" if:

(a) The area is not so contaminated with fecal material that consumption of the shellfish might be detremintal to the health of the public.

(b) The area is not so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be detremintal to the health of the public. (see He-P 2152.07, regarding toxins in shellfish growing areas), and

(c) The coliform median MPN of the water does not exceed 70 per 100 ml., and not more than 10 percent of the samples ordinarily exceed an MPN of 230 per 100 ml. for a 5-tube decimal dilution test (or 330 per 100 ml. where the 3-tube decimal dilution test is used) in those portions of the area most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions. The foregoing limits need not be applied if it can be shown by detailed study that the coliforms are not of direct fecal origin and do not indicate a public health hazard.

(d) The concentration of paralytic shellfish poison is less than 80 micrograms per 100 grams of the edible portion of raw shellfish on at least three consecutive samples.

He-P 2152.04 Conditionally Approved Areas. An area shall be classified as "conditionally approved" if:

(a) The water quality requirements for an approved area are met at all times while the area is approved as source of shellfish for direct marketing.

(b) An operating procedure for each conditionally approved area is developed jointly by the Division, local agencies, including those responsible for operation of sewerage systems, and the local shellfish industry. The operating procedure shall be based on an evaluation of each of the potential sources of pollution which may affect the area. The procedure shall establish performance standards, specify necessary safety devices and measures, and define inspection and check procedures.

(c) A closed safety zone is established between the conditionally approved area and the source of pollution to give the Division time to stop shellfish harvesting if performance standards are not met.

(d) Boundaries of conditionally approved areas is so marked as to be readily identified by harvesters.

(e) Critical sewerage system units are so designed, constructed, and maintained that the chances of failure to meet the established performance standards due to mechanical failure or overloading are minimized.

(f) There is a complete understanding of the purpose of the conditionally approved classification by all parties concerned, including the shellfish industry.

(g) Any failure to meet the performance standards is immediately reported to the Division by telephone or messenger.

(h) The Division immediately recommends closure of conditionally approved areas to shellfish harvesting following a report that the performance standards have not been met. The area remains closed until the performance standards can again be met plus a length of time sufficient for the shellfish to purify themselves so that they will not be a hazard to the public health.

(i) The Division makes at least two evaluations during the shellfish harvesting season of each conditionally approved area including inspection of each critical unit of the sewerage system to determine the general mechanical condition of the equipment, the accuracy of recording devices, and the accuracy of reporting by the operating agency.

(j) If it is discovered that failure to meet performance standards have not been reported by the operating agency, or if the performance standards are not met, the area immediately reverts to a restricted or prohibited classification.

(k) All data relating to the operation of a conditionally approved area, including operation of sewerage systems, are maintained in a file by the Division.

He-P 2152.05 Restricted Areas. An area shall be classified as "restricted" if:

(a) The area is so contaminated with fecal materials that direct consumption of the shellfish might be detremintal to the health of the public and/or

(b) The area is so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be detremintal to the health of the public and/or

(c) The coliform median MPN of the water exceeds 70 per 100 ml. but does not exceed 700 per 100 ml. and not more than 10 percent of the samples exceed an MPN of 2,300 per 100 ml. in those portions of the areas most probably exposed to fecal contamination during the most unfavorable hydrographic and pollution conditions.

He-P 2152.06 Marketing Prohibited. Shellfish from restricted areas shall not be marketed without controlled purification or relaying.

He-P 2152.07 Prohibited Areas. An area shall be classified as "prohibited" if:

(a) The area is so contaminated with radionuclides or industrial wastes that consumption of the shellfish might be detrimental to the health of the public and/or

(b) The median coliform MPN of the water exceeds 700 per 100 ml. or more than 10 percent of the samples have a coliform MPN in excess of 2,300 per 100 ml.

(c) The concentration of paralytic shellfish poison equals or exceeds 80 micrograms per 100 grams of the edible portion of raw shellfish.

(d) Notification shall be made to the NH Fish and Game Department when an area is classified as prohibited.

He-P 2152.08 Marketing Prohibited. No market shellfish shall be taken from prohibited areas.

He-P 2152.09 Reserved

APPENDIX III

HAMPTON HARBOR SANITARY SURVEY

HAMPTON HARBOR SANITARY SURVEY

DIVISION OF PUBLIC HEALTH SERVICES

MARCH 1988

Prepared By

Paul Raiche
Shellfish Sanitarian

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88-006

INTRODUCTION

The Division of Public Health Services, Department of Health and Human Services is responsible for classifying shellfish waters in the State of New Hampshire. Waters are classified as "approved" if the median total coliform level of at least twelve to fifteen samples "does not exceed 70 MPN per 100 ml. and not more than 10 percent of the samples exceed an MPN of 230 per 100 ml." (New Hampshire Rules For Food, He-P 2100). If the median total coliform level does exceed 70 MPN per 100 ml. but does not exceed 700 MPN per 100 ml., then the area is classified as "restricted". Areas exceeding a median total coliform level of 700 MPN per 100 ml. are classified as "prohibited".

Hampton Harbor is located in Southeastern New Hampshire. It is fed by several rivers and streams, the largest being the Blackwater River which flows from Massachusetts, through a part of Seabrook, New Hampshire and then into the Harbor. The Taylor River flows from the west along the town line of Hampton and Hampton Falls. Prior to entering the harbor, it is joined by the Hampton Falls River and becomes the Hampton River. Most of the Harbor is presently classified as "approved" (see Figure 1). This includes the harbor proper and extends to the mouth of each of the rivers. From these points back up-river to the location of previous sampling stations located at roads or the railroad track, the rivers are unclassified. Upstream from the roads (Routes 51 and 286) and the railroad tracks, each stream is classified "restricted".

Although shellfish must not be taken from unclassified waters according to New Hampshire Fish & Game Department (F & G) rules (FIS 606.02 (b)), He-P 2150.02(a) (from the New Hampshire Rules for Food) states the division shall insure that: "National Program requirements are applied to all actual and potential shellfish growing areas." The National Shellfish Sanitation Program, Manual of Operations, Part I (1986 revision) states in section C2a that "all actual and potential shellfish growing waters... are correctly designated", as a requirement for satisfactory compliance with the Program.

This report will use all available data in an attempt to properly classify all of Hampton Harbor. This will include water samples, shoreline surveys and meteorological data.

SHORELINE SURVEY

Due to the large area that impacts upon Hampton Harbor and because of shortage of time and manpower, it was decided that only the area immediately adjacent to the harbor would be surveyed. Rivers and streams emanating beyond certain borders were treated as point sources and were sampled where they intercepted these borders. The area surveyed (see Figure 2) is therefore delineated by Route 1A from Route 286 in Seabrook north to Ashworth Street, north to Route 51, west to the B & M Railroad tracks, and south to Browns River. Here, the area surveyed is bordered by Seabrook Station property and then by Causeway Street, south to Walton Road, and then across the marsh following the tree line to Route 286, and then east back to Route 1A.

This area consists primarily of tidal flats and marshes surrounding five rivers (Blackwater, Browns, Hampton, Hampton Falls, and Taylor Rivers) and several small creeks (see figure 3).

Most of the area is unpopulated and therefore the surveys in these areas consisted primarily of sampling streams and creeks entering the larger rivers. Samples did not indicate serious problems but there <u>are</u> indications of unknown sources in Hunts Island Creek and Mill Creek, both in Seabrook. Browns River at the railroad tracks also showed an elevated total coliform MPN (2500/100 ml.). Although two large pipes were seen coming from Seabrook Station property, they were dry and a United States Environmental Protection Agency "Fact Sheet" filed with the New Hampshire Department of Environmental Services, Water Supply & Pollution Control Division indicated that they would no longer be used after construction was completed, and that even when used, waste water had been subjected to tertiary treatment.

Also surveyed was the area of Hampton along the Taylor and Hampton Rivers. Most of the residential areas are on town sewer or were said to be slated for tie-in to town sewer during the past summer, according to the Hampton plant officials. Personal observation of this construction was witnessed by this writer. However, the presence of the Hampton River Boat Club on the Taylor River (located at Hampton landing just upriver of Nudd's Canal) with fifteen or more boats and about 100 members likely has an adverse impact on the water quality of the river. This club is not presently on town sewer.

Probably the area which has the most problems aside from the major rivers entering the harbor is along the east shore of the harbor on the Seabrook side. Here, many homes are located which have private systems usually consisting of septic tanks which are either flooded by high tide or are less than 75 feet from the water line. Although the tanks are underground, these homes most likely are contributing fecal contamination to the harbor. When and if Seabrook builds a sewage treatment plant, these homes must be tied into the system if the water quality in this part of the harbor is to improve. Of particular concern is the area immediately adjacent to Route 1A which is used as a shipping channel for party boats and fishing boats. There also are a couple of restaurants located within this area. These sources may be responsible for the occasional high counts found at Station HH1 (see section on "Water Quality Data").

WATER QUALITY DATA

Although many water samples have now been taken in the harbor, there still remain some unanswered questions. The most important is the cause of the occasional high bacterial counts seen at the mouth of the harbor (HH1 and HH1A). Four of the last sixteen samples taken at these stations revealed total coliform levels greater than 230 MPN/100 ml. While these can be attributed to rainfall, it is a dilemma that the bacterial levels at the mouth of the harbor are greater than those found in the harbor, closer to the expected sources of pollution.

The remaining stations show primarily "restricted" levels of bacteria. HH2 is located upstream in the Blackwater River. Only four samples were taken during this time span, but results were consistent with historic results taken during 1985 and early 1986. The median total coliform level is 205 MPN/100 ml. and half were over 230. HH2A was initially sampled in July of 1986 in an attempt to determine how much, if any, dilution was occurring as the river neared the harbor. Also the station is closer, but still upstream, of a large clam flat. The median total coliform level is 230 MPN/100 ml. with 38% over 230. Also, the median fecal level was 70 MPN/100 ml. Stations HH3, HH4, and HH5 are old stations whose previous data indicated a "restricted" classification. Most of the recent data is consistent with that classification. HH5A was selected in 1986 to determine the level of bacteria that Tidemill Creek was contributing to the Hampton River. After fourteen samples, the median total coliform level was 170 MPN/100 ml. and 43% were greater than 230 MPN/100 ml. HH12 was selected because it is immediately upstream of a large clam flat. The medium total coliform level was 33 MPN/100 ml. and 8% were over 230 MPN/100 ml.

HH15 was picked because it is located at the confluence of the Hampton Falls River and the Tayor River, both of which exhibited rather high bacterial levels previously. If any dilution was occurring, it should be apparant by comparing stations HH3 and HH4 to HH15. HH3 had a median total coliform level of 295 MPN/100 ml. with 57% over 230 and HH4 had a median total coliform level of 460 MPN/100 ml. and 53% over 230. This compares to HH15 where the median value was 49 MPN/100 ml. and 15% were over 230. Although these samples were not taken during the same time frames, the number of samples allow us to conclude that the high levels of bacteria are being diluted as the rivers enter the harbor.

CLASSIFICATION

The main purpose of this report was to classify those areas of Hampton Harbor which had not been previously classified. With one exception (HH12), all the stations set up to determine these classifications failed the requirements of an approved area (see Table 2). Station HH12 is located on the Browns River (See Figure 3) in a currently approved area. While this gives us confidence regarding this classification, the result seen at station BR9 taken during a June 1st shoreline survey does not allow us to expand this approved area. Therefore, it is recommended that all unclassified areas be classified as "restricted". The approved area of Hampton River should be reduced so as not to encompass station HH5A (see figure 4). And a small area directly adjacent to Route 1A should be classified as "restricted" due to the boat travel through that area.

RECOMMENDATIONS

Whenever an area is classified "approved" the National Shellfish Sanitation Program, Manual of Operations, Part I (1986 Revision) states in section C1e that "at least five (5) water quality samples from each station" be collected annually. Therefore, it is recommended that sampling be continued, but that certain stations be moved. In particular station HH2A and HH5A should be moved to the edge of the new approved boundaries and be re-named HH2B and HH5B. These should allow us to monitor these approved areas more closely.

The Department of Environmental Services should work closely with the local officials in the towns abutting the harbor to locate and abate any point sources of pollution. These sources are indicated by the high levels of bacteria found primarily in the Taylor and Hampton Falls Rivers but also in all the streams flowing into the harbor.

If, and when, the Town of Seabrook builds a sewage treatment plant (as is now planned), a complete re-appraisal should be conducted to determine if the approved area could be enlarged.

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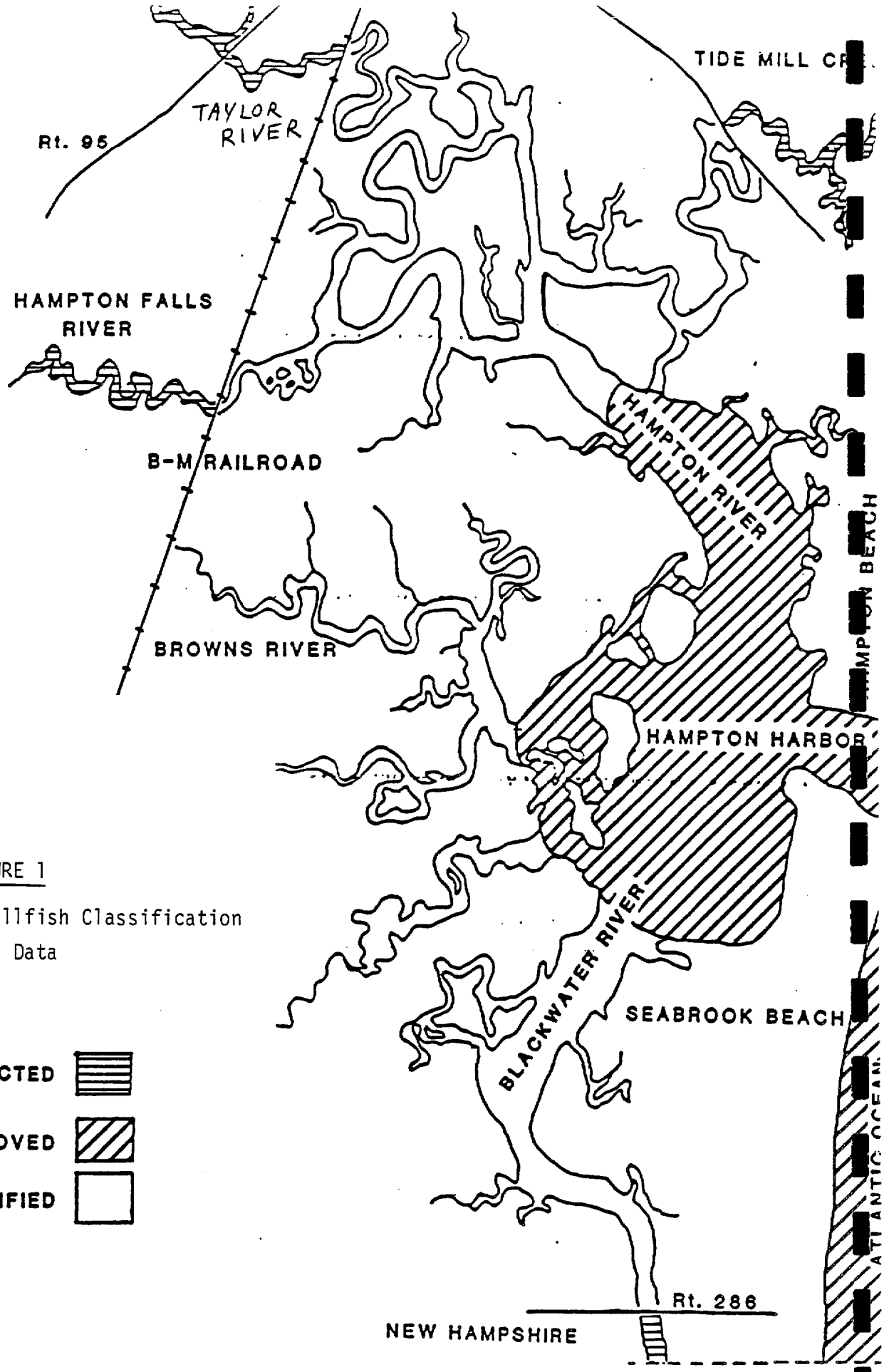


FIGURE 1

Hampton Harbor Shellfish Classification
1987 Data

RESTRICTED

APPROVED

UNCLASSIFIED

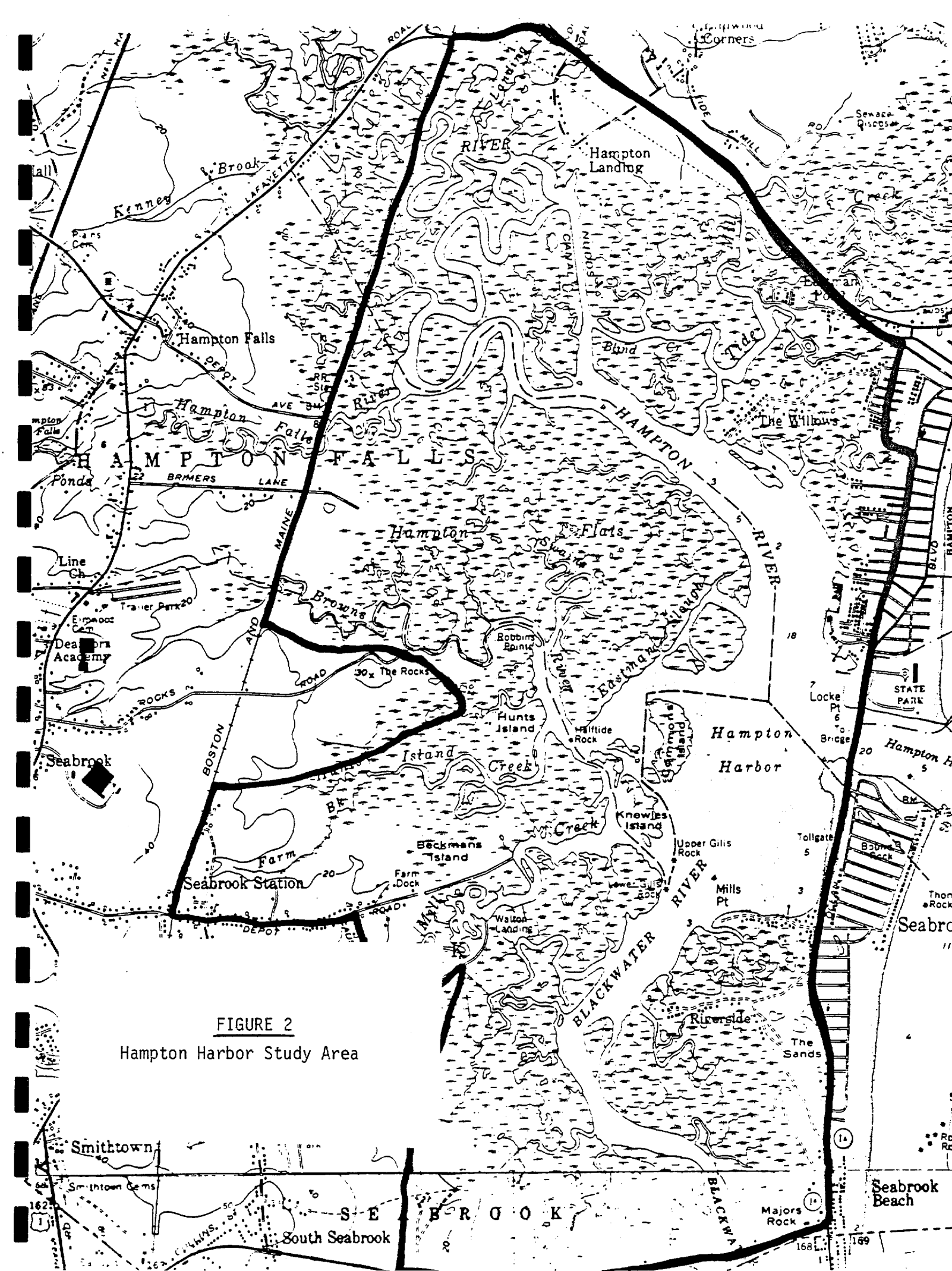


FIGURE 2

Hampton Harbor Study Area

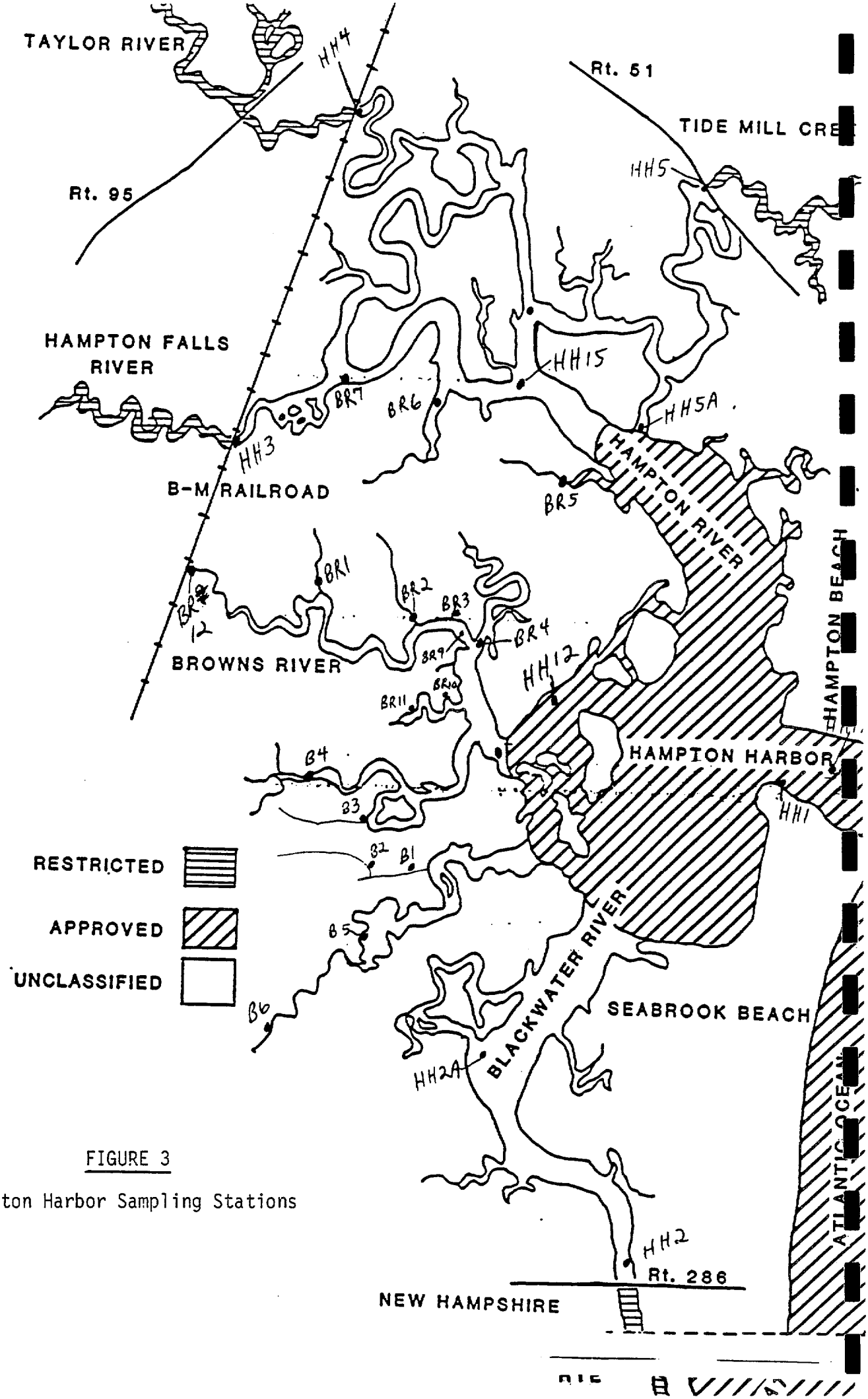


FIGURE 3

Hampton Harbor Sampling Stations

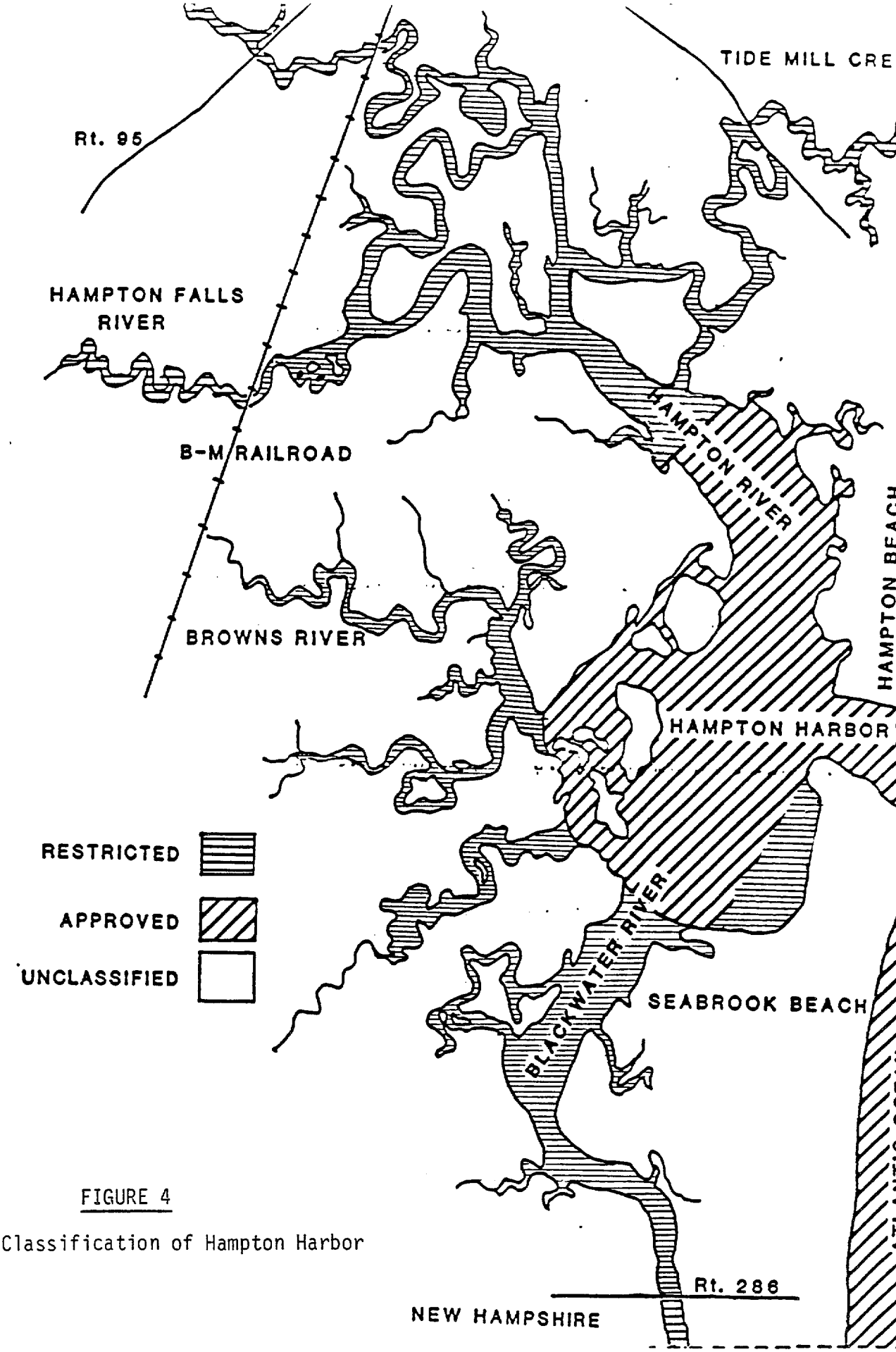


FIGURE 4

Proposed Classification of Hampton Harbor

TABLE I

STATION	DATE	RESULT	TIME	LOW TIDE	RAIN
BR 9	6-1-87	1100	10:14	9:20	0.38
BR10	6-1-87	2400	10:30	9:20	0.38
BR11	6-1-87	43	10:35	9:20	0.38
BR12	6-1-87	2400	11:01	9:20	0.38
BR 1	6-1-87	23	9:32	9:20	0.38
BR 2	6-1-87	9	9:26	9:20	0.38
BR 3	6-1-87	41	10:32	9:20	0.38
BR 4	6-1-87	23	10:30	9:20	0.38
HH 3	6-1-87	1100	11:32	9:20	0.38
HF 1	6-1-87	280	11:38	9:20	0.38
HF 2	6-1-87	2400	11:43	9:20	0.38
HF 3	6-1-87	46000	11:48	9:20	0.38
B 1	7-6-87	23	10:20	3:10	0.04
B 2	7-6-87	75	10:41	3:10	0.04
B 3	7-6-87	43	10:54	3:10	0.04
B 4	7-6-87	2100	11:02	3:10	0.04
B 5	7-6-87	110	11:45	3:10	0.04
B 6	7-6-87	4600	12:38	3:10	0.04
BR5	7-6-87	23	10:55	3:10	0.04
BR6	7-6-87	23	10:30	3:10	0.04
BR7	7-6-87	75	10:15	3:10	0.04
HH11	8-3-87	11000	11:42	11:54	0.87
HF 3	8-3-87	110,000	11:32	11:54	0.87
HF 4	8-3-87	15,000	11:21	11:54	0.87
HF 5	8-3-87	110,000	11:08	11:54	0.87
HF 6	8-3-87	24,000	10:57	11:54	0.87
B 6	2-8-88	23	9:15	8:36	Unknown
B 7	2-8-88	49	9:23	8:36	
B 8	2-8-88	6.8	9:34	8:36	
B 9	2-8-88	33	9:44	8:36	
B 10	2-8-88	79	9:51	8:36	

TABLE II

SUMMARY OF HAMPTON HARBOR RESULTS

TIME PERIOD	STATION	# OF SAMPLES	MEDIAN TOTALS	% OVER 230
6/86-11/87	HH1A	4	76	25
6/86-11/87	HH2A	14	230	36
6/86-11/87	HH5A	15	110	40
6/86-11/87	HH12	13	17	8
6/86-11/87	HH15	14	33	14
5/85-11/87	HH1	25	23	16
5/85-11/87	HH2	16	275	50
5/85-11/87	HH3	14	295	57
5/85-11/87	HH4	15	460	53

APPENDIX IV

RYE HARBOR EVALUATION

RYE HARBOR

EVALUATION

by

Paul Raiche

DPHS

4/1/87

INTRODUCTION

Rye Harbor is presently unclassified. The New Hampshire Fish & Game Department does not allow taking of shellfish from areas which are unclassified (FIS 606.02(b)). However, the National Shellfish Sanitation Program, Manual of Operations, Part I (1986revision) states in section C2a that "All actual and potential shellfish growing waters . . . are correctly designated",as a requirement for satisfactory compliance with the Program. Furthermore, He-P 2150.02(a), from the New Hampshire Rules for Food, states the division shall insure that: "National Program requirements are applied to all actual and potential shellfish growing areas."

This report will recommend classification of Rye Harbor which is consistent with national standards and is based upon all available data which has been gathered during over a year of water samples and several shoreline reconnaissances.

SHORELINE SURVEY

Rye Harbor is primarily influenced by tidal flushing. The tributaries are very small in comparison to the amount of water which flows into and out of the harbor during each tidal exchange.

Two streams enter Rye Harbor, one from the north and one from the south. The southern stream begins in a swampy wooded area between Washington Road to the west and Central Road to the east. Located near the beginning of the stream is Philbrick's Septage Lagoon. The lagoon is well removed from the stream and is situated on a gently sloping, well-vegetated area. Samples taken immediately downstream of the lagoon (RH6) revealed fewer coliform bacteria than those stations located nearer to Rye Harbor. The stream then flows through Evergreen of Rye (a small nursery located on Central Road), past Central Road, through approximately a half mile of woods and into a small marsh, where a second stream joins it from the south. This second stream flows from a residential area alongside Route 1A. Sample stations were located 20-30 yards upstream of the fork (RH8 was on original stream, RH7 on the secondary stream). From this point the stream flows past Locke Road under Route 1A, and then past a hotel/restaurant complex and into a salt-marsh, before finally emptying into Rye Harbor by passing under Rye Harbor Road (RH1).

SHORELINE SURVEY CON'T.

A second stream enters Rye Harbor from the north from a large salt-marsh. This stream is almost entirely tidal with several forks, a few of which emanate along the eastern side of the marsh where two restaurants and ten to fifteen homes are located.

WATER QUALITY DATA

Analysis of the water quality data indicates water quality which ranges from prohibited to restricted. RH1 is located at the bridge on Rye Harbor Road. Samples taken from May of 1985 through March 1987 show a median total coliform level of 230/100 ml.with 44% over 230/100 ml.and 12.5% over 2300/100 ml. RH2 is located at the bridge on Route 1A and results show a median total coliform level of 170/100 ml. with 31% over 230/100 ml. and 12.5% over 2300/100 ml. RH4 is located at the end of the state-maintained "mole" (see exhibit 1) and has resulted in a median of 23/100 ml with 10% over 230/100 ml. RH3 is located at the end of the northern breakwater at the entrance of the harbor. The median total coliform level of RH3 is 90/100 ml. with 38% over 230/100 ml.

CLASSIFICATION

It is recommended that the section of the stream flowing into the southern end of Rye Harbor from the bridge on Harbor Road south and the section of the stream flowing into the northern end of Rye Harbor from the bridge on Route 1A north be classified as "prohibited". It is further recommended that the rest of the harbor out to the two breakwaters at the mouth of the harbor be classified "restricted".

RECOMMENDATIONS

1. The routine sampling of Rye Harbor (RH1, 2, 3 & 4) should be continued.

2. The tributaries flowing into Rye Harbor should be sampled more extensiv ly.

3. Dye-testing of private septic systems abutting the tributaries should be conducted to locate potential point sources of contamination.

RECOMMENDATIONS CON'T.

4. Appropriate regulatory action should be commenced for those situations found not to be in compliance.

EXHIBIT I

Rye Harbor Shellfish Classification

1987 Data

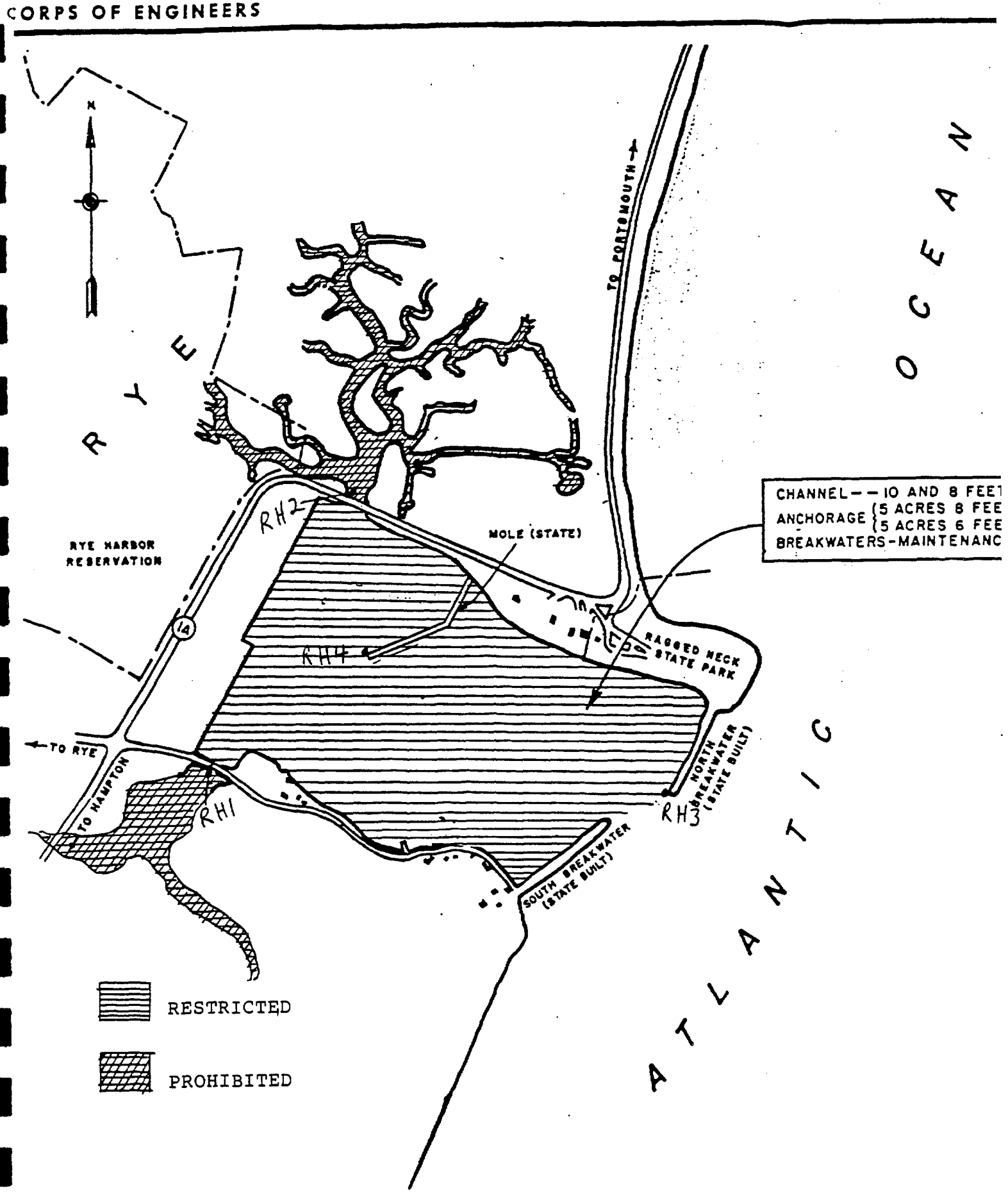
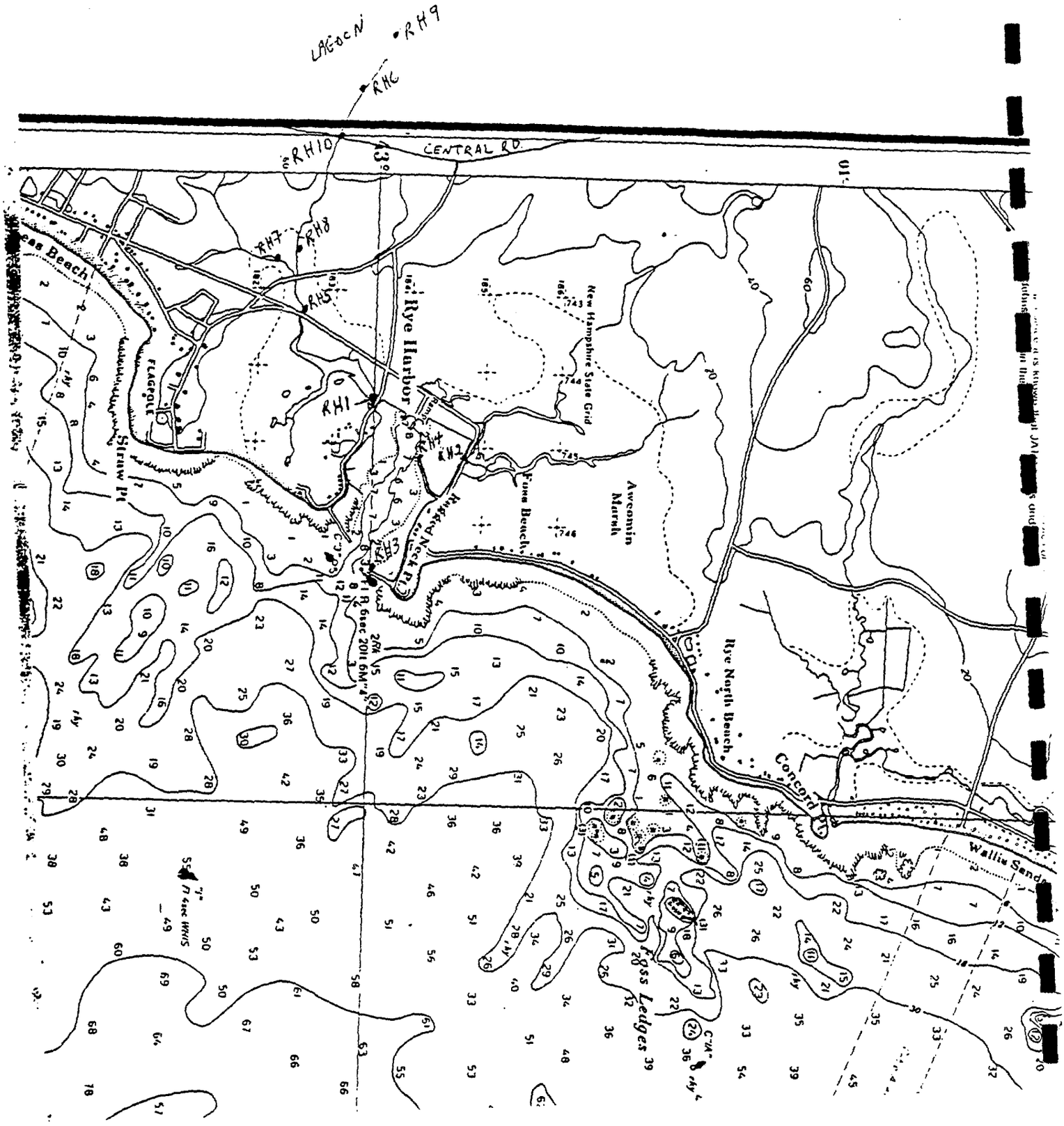


EXHIBIT II

Rye Harbor Sampling Stations



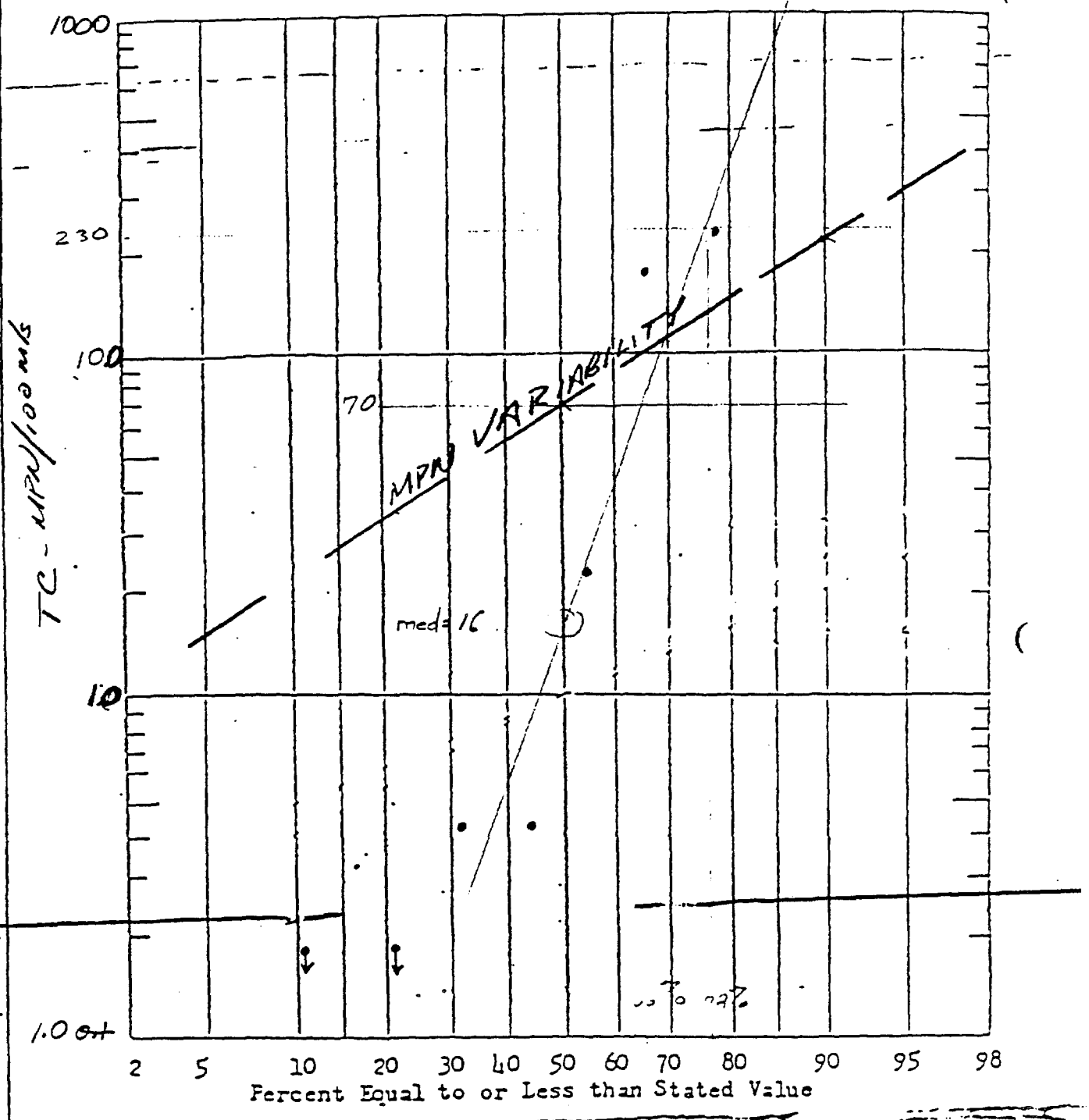
LOCATION	DATE	*COLIFORM MPN/100 ml.		FECAL COLIFORMS 100 ml
		PHS LAB	WS&PCC LAB	DPHS LAB
RH1	11/12/85	330	930	230
RH2	"	230	430	79
RH3	"	330	390	49
RH1	12/02/85	230	24000	330
RH2	"	220	24000	7.8
RH3	"	330	930	46
RH1	01/27/86	2200	46000	230
RH2	"	1300	2400	79
RH3	"	130	270	11
RH1	02/18/86	49	150	33
RH2	"	17	<30	4.0
RH3	"	49	40	9
RH1	03/03/86	130	430	79
RH2	"	4.0	<30	2.0
RH3	"	<1.8	<30	<1.8
RH1	04/21/86	23	90	7.8
RH2	"	<1.8	<30	<1.8
RH3	"	<1.8	<30	<1.8
RH1	05/05/86	330	460	49
RH2	"	6.1	7.0	<1.8
RH4	"	<1.8	<3.0	<1.8
RH1	06/30/86	230	750	27
RH2	"	79	2400	1.8
RH4	"	<1.8	28	<1.8
RH1	07/28/86	5400	4600	330
RH2	"	3500	1100	95
RH4	"	1300	2400	230
RH1	08/26/86	22	93	22
RH2	"	170	1100	9.3
RH4	"	4.5	15	4.5
RH1	09/29/86	230	460	49
RH2	"	490	240	33
RH4	"	4.5	3	4.5
RH1	10/27/86	16000	46000	1500
RH2	"	790	460	1.8
RH4	"	23	240	<1.8
RH1	11/17/86	7.8	150	<1.8
RH2	"	3400	2400	<1.8
RH4	"	170	93	6.8

LOCATION	DATE	*COLIFORM MPN/100 ml.		FECAL COLIFORMS 100 ml
		PHS LAB	WS&PCC LAB	DPHS LAB
RH1	01/26/87	490	460	230
RH2	"	7.8	93	1.8
RH4	"	22	23	13
RH1	02/23/87	170	2400	17
RH2	"	23	93	<1.8
RH3	"	<1.8	<30	<1.8
RH4	"	6.8	23	2.0
RH1	03/23/87	330	240	49
RH2	"	170	150	<1.8
RH3	"	330	240	330
RH4	"	79	93	79

RYE HARBOR – RH 4

EXHIBIT IV

22% of the time results will be > 230
16% " " " med. " " > 70



MPN VARIATION

FIG. 10

APPENDIX V

NEW HAMPSHIRE FISH & GAME DEPARTMENT RULES

48 inches in maximum width or a hydraulic dredge with a blade, knife or manifold which is greater than 48 inches in maximum width.

Source. #745, eff 1-25-76; amd by #1165, eff 5-18-78; amd by #1878, eff 12-4-81; amd by #2563, eff 12-27-83; ss by #2741, eff 6-13-84

Fis 606.02 Taking of Clams

(a) The taking of clams (Mya arenaria) shall only be permitted, between sunrise and sunset, on Fridays and Saturdays, from the day after Labor Day to May 31.

(b) Mollusks shall not be taken from areas which are unclassified or are classified as "prohibited" by the director of the division of public health services or posted as closed, or marked with red stakes. Mollusks shall not be taken by recreational harvestors from areas classified as "restricted" by the director of the division of public health services. Commercial harvesting and marketing from "restricted" areas shall be allowed under certain conditions specified in the rules of the department of health and human services, division of public health services (He-P 2152, and He-P 2153).

(c) Clams shall be dug only with hand held tools with handle lengths not to exceed eighteen (18) inches.

Source. #954, eff 6-10-77; amd by #745, eff 1-25-76; ss by #2263, eff 1-7-83; ss by #2839, eff 8-31-84; amd by #3021, eff 5-20-85; amd by #4122, eff 8-21-86

Fis 606.03 Identification of Clam Containers.

(a) Any container used in the taking of clams, whether on the flats, on a dock or landing, or in a boat, shall be clearly identified by marking thereon the owner's clam license number, either by attaching a waterproof tag containing such number to said container, or by painting such number on the outside of said container.

(b) By applying for a clam license, the licensee shall be deemed to have consented to submit to department inspection for the identifying number referred to in paragraph (a) above.

(c) Unnumbered containers found in the places referred to in paragraph (a) above, and their clam contents, shall become the property of the state.

Source. #745, eff 1-25-76; ss by #2263, eff 1-7-83; ss by #2839, eff 8-31-84

APPENDIX VI

TIDEWATER SAMPLING DATA 1987

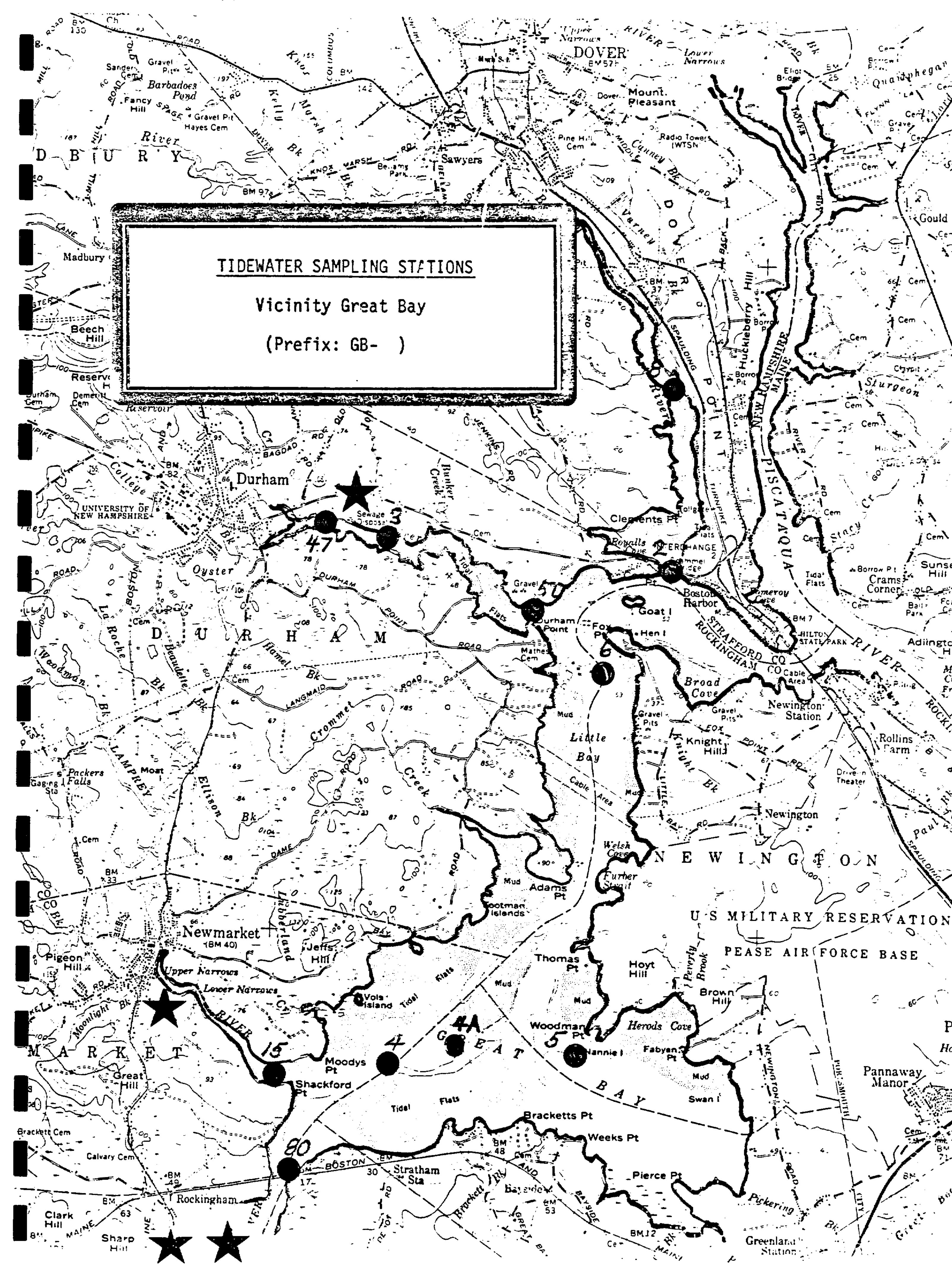
&

CURRENT CLASSIFIED AREAS

TIDEWATER SAMPLING STATIONS

Vicinity Great Bay

(Prefix: GB-)



1987 TIDEWATER SAMPLING DATA

(In cooperation with Environmental Health Division)

GREAT BAY AND TRIBUTARIES

STATION GB-2 LOCATION: Bellamy R, At Rte 4 bridge LAT. 43° 04.2 LONG. 70° 43.7'

DATE	TIME	TIDE(+30)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	14:28	- 2:19	32	460	240	< 30	Boat station
Apr 13	13:30	- 3:33	44	460	43	90	
May 18	12:21	+ 2:05	56	460	39	< 30	
Jun 15	10:50	+ 1:44	68	210	75	< 30	
Jul 13	10:42	+ 2:46	69	150	460	30	
Aug 03	13:10	+ 0:55	69	93	9	< 30	
Sep 28	10:00	+ 0:21	58	43	23	< 30	
Oct 12	09:35	- 0:08	51	460	240	150	
Nov 09	12:53	+ 5:26	47	930	93	40	
Dec 21	11:18	+ 6:05	37	460	460	90	
			Log Average (10)	274	88	< 45	

STATION GB-8 LOCATION: Bellamy R, channel jog LAT. 43° 09.1 LONG. 70° 50.0'

DATE	TIME	TIDE(+30)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 15	11:08	+ 2:02	72	1,100	75	90	Boat station
Aug 03	13:00	+ 0:45	62	1,100	1,100	430	
Sep 28	09:50	+ 0:11	56	240	23	70	
Oct 12	09:24	- 0:19	50	460	240	430	
Nov 09	12:36	+ 5:09	47	93	93	40	
			Log Average (5)	257	67	136	

STATION GB-50 LOCATION: Oyster R, mouth LAT. 43° 07.7 LONG. 70° 52.1'

DATE	TIME	TIDE(+35)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	14:23	- 2:29	32	240	240	40	Boat station
May 18	13:56	+ 3:35	55	240	43	< 30	
Jun 15	11:19	+ 2:08	69	2,400	43	40	
Jul 13	10:45	+ 2:44	69	240	93	< 30	
Sep 28	10:41	+ 0:57	58	39	23	40	
Oct 12	10:15	+ 0:27	51	4,600	1,100	< 30	
Nov 09	10:43	+ 3:11	45	93	93	4	
Dec 21	10:10	+ 4:52	35	240	43	< 30	
			Log Average (8)	328	90	< 26	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

STATION GB-3 LOCATION: Oyster R, Johnson's Ck LAT. 43° 07.9 LONG. 70° 53.8'

DATE	TIME	TIDE(+35)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	14:13	- 2:39	31	1,100	240	90	Boat station
Apr 13	13:16	- 3:52	45	43	7	< 30	
May 18	14:07	+ 3:46	59	4,600	460	< 30	
Jun 15	11:29	+ 2:18	73	4,600	1,100	40	
Jul 13	10:53	+ 2:52	72	2,400	240	430	
Aug 03	13:42	+ 1:22	74	2,300	240	230	
Sep 28	10:32	+ 0:48	56	1,100	75	210	
Oct 12	10:05	+ 0:17	50	46,000	24,000	930	
Nov 09	10:36	+ 3:04	45	15	4	< 30	
Dec 21	09:57	+ 4:39	33	150	43	< 30	
			Log Average (10)	955	165	< 94	

STATION WWTF LOCATION: Oyster R, Durham WWTF outfall LAT. LONG.

DATE	TIME	TIDE(+50)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 15	11:34	+ 2:08	74	110,000	2,400	430	Boat station
Sep 28	10:26	+ 0:27	--	23	< 30	40	
Oct 12	09:59	- 0:04	--	>240,000	>240,000	7,500	
Nov 09	10:34	+ 2:47	46	>240,000	46,000	46,000	
Dec 21	09:52	+ 4:19	35	240	23	< 30	
			Log Average (5)	> 8,105	> 184	< 708	

STATION GB-47 LOCATION: Oyster R, vic Beards Ck LAT. 43° 08.0 LONG. 70° 54.7'

DATE	TIME	TIDE(+35)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
May 18	14:14	+ 1:19	63	24,000	4,600	90	Boat station
Jun 15	11:40	+ 2:29	75	1,500	240	40	
Jul 13	11:00	+ 2:59	73	390	240	430	
Sep 28	10:21	+ 0:37	56	700	460	1,500	
Oct 12	09:55	+ 0:07	52	4,600	1,100	4,600	
Nov 09	10:25	+ 2:53	47	< 3	< 3	< 30	
Dec 21	09:47	+ 4:29	33	1,400	43	40	
			Log Average (7)	< 789	< 162	< 200	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

STATION GB-6 LOCATION: Little Bay, Buoy N4 LAT. 43° 06.9 LONG. 70° 51.7'

DATE	TIME	TIDE(+35)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	13:55	- 2:57	33	1,100	240	40	Boat station
Apr 13	12:54	- 4:14	48	460	150	40	
May 18	13:52	+ 3:31	55	240	43	< 30	
Jun 15	12:00	+ 2:49	66	2,400	460	< 30	
Jul 13	11:18	+ 3:17	70	390	43	< 30	
Aug 03	13:55	+ 1:35	69	43	4	< 30	
Sep 28	11:24	+ 1:40	59	240	< 30	< 30	
Oct 12	11:00	+ 1:12	52	93	23	< 30	Log-in as GBL
Nov 09	12:15	+ 4:43	45	75	9	< 30	
Dec 21	10:11	+ 4:53	36	460	460	40	
			Log Average (10)	288	< 57	< 33	

STATION GB-4A LOCATION: Middle of Great Bay LAT. 43° 04.2 LONG. 70° 53.3'

DATE	TIME	TIDE(+50)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Aug 17	14:00	+ 1:01	--	< 3	< 3	40	Sampled by F&G
Sep 28	11:14	+ 1:15	59	23	23	< 30	New boat stati
Oct 12	10:50	+ 0:47	51	43	15	40	
Nov 09	11:55	+ 4:08	44	23	23	< 30	
Dec 21	10:26	+ 4:53	33	93	93	< 30	
			Log Average (5)	< 23	< 18	< 34	

STATION GB-4 LOCATION: Upper Middle of Great Bay LAT. 43° 04.1 LONG. 70° 53.7'

DATE	TIME	TIDE(+50)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	13:33	- 3:34	32	150	93	90	Boat station
Apr 13	12:34	- 4:49	48	1,100	93	40	
May 18	13:33	+ 2:57	60	46,000	4,600	< 30	
Jun 15	12:10	+ 2:44	72	24,000	2,400	40	
Jul 13	11:28	+ 3:12	73	460	460	40	
Aug 03	14:07	+ 1:32	74	46,000	46,000	230	
Aug 17	14:15	+ 1:16	--	23	23	110	Sampled by F&G
Sep 28	11:09	+ 1:10	59	93	93	40	
Oct 12	10:46	+ 0:43	51	43	23	40	
Nov 09	11:50	+ 4:03	45	430	150	40	
Dec 21	10:30	+ 4:57	33	460	460	40	
			Log Average (11)	785	339	< 54	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME TIDE Data entries are time from low tide at location.

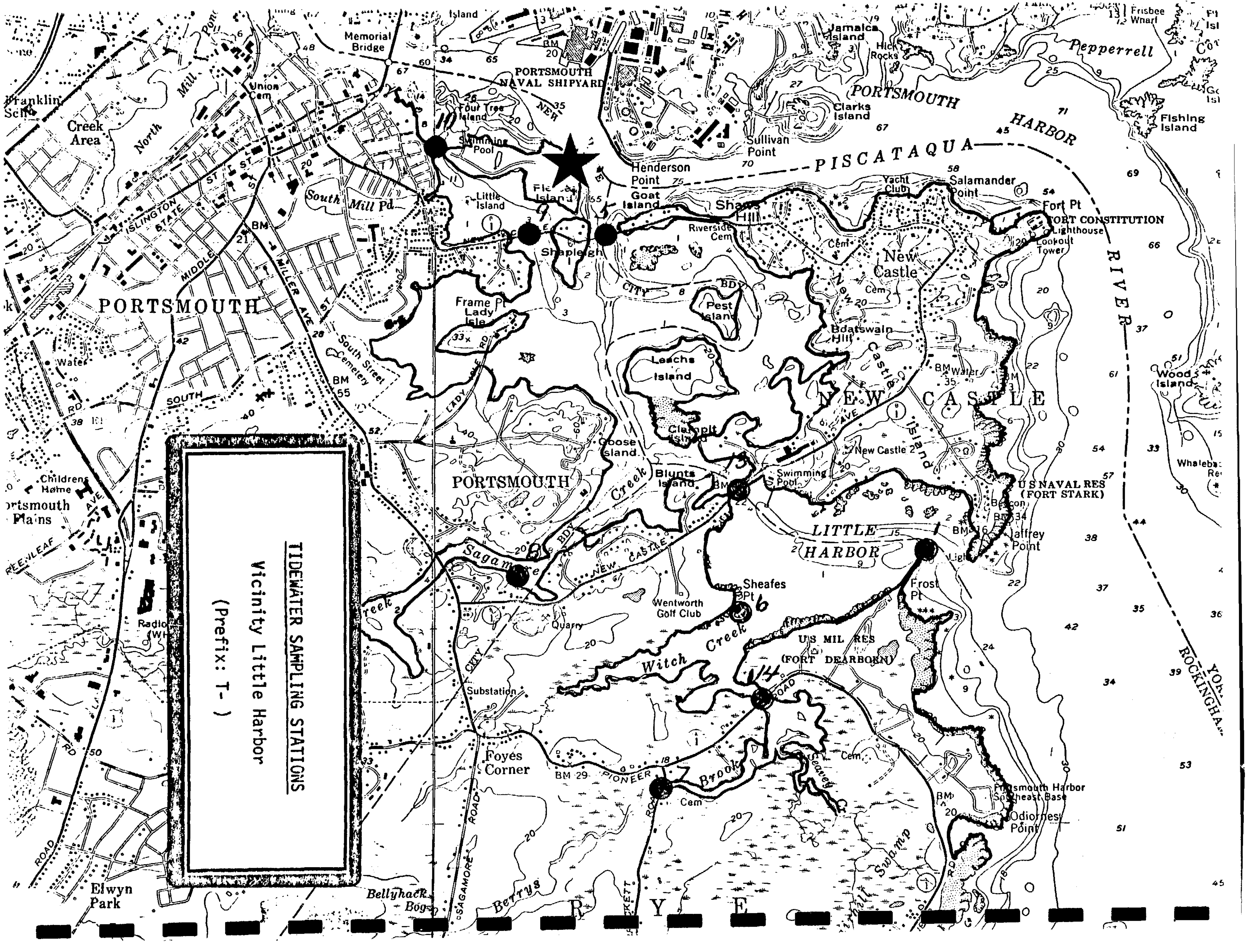
STATION GB-15 LOCATION: Lamprey R, mouth LAT. 43° 03.7 LONG. 70° 54.8'

DATE	TIME	TIDE(+50)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	13:22	- 3:45	32	460	43	90	Boat station
Apr 13	12:27	- 4:56	47	1,100	23	90	
May 18	13:22	+ 2:46	61	11,000	11,000	150	
Jun 15	12:15	+ 2:49	73	>240,000	11,000	230	
Jul 13	11:32	+ 3:16	74	1,100	460	< 30	
Aug 03	14:12	+ 1:37	75	>240,000	>240,000	930	
Sep 28	10:56	+ 0:57	58	1,500	1,500	90	
Oct 12	10:30	+ 0:27	52	390	240	230	
Nov 09	11:23	+ 3:36	46	150	15	40	
Dec 21	10:38	+ 5:05	32	11,000	2,400	230	
			Log Average (10)	> 3,574	> 838	< 131	

STATION GB-80 LOCATION: Squamscott R, under RR bridge LAT. 43° 03.2 LONG. 70° 54.8'

DATE	TIME	TIDE(+50)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 13	13:11	- 3:56	32	4,600	150	90	Boat station
Apr 13	12:18	- 5:05	48	4,600	240	90	
May 18	13:01	+ 2:25	62	2,000	150	90	
Jun 15	12:21	+ 2:55	74	1,100	240	40	
Jul 13	11:38	+ 3:22	75	3,900	240	430	
Aug 03	14:18	+ 1:43	75	240	240	90	
Sep 28	11:03	+ 1:04	58	460	460	40	
Oct 12	10:39	+ 0:36	52	1,500	240	150	
Nov 09	11:42	+ 3:55	44	43	23	< 30	
Dec 21	10:48	+ 5:15	33	1,500	240	40	
			Log Average (10)	957	184	< 79	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.


TIDEWATER SAMPLING STATIONS
Vicinity Little Harbor
(Prefix: T-)
PORTSMOUTH
NEW CASTLE
RYE
PISCATAQUA RIVER
PORTSMOUTH HARBOR
LITTLE HARBOR
PORTSMOUTH NAVAL SHIPYARD
Memorial Bridge
Sagamore Creek
Witch Creek
Berrys Brook
Pioneer Road
Foyes Corner
Elwyn Park
Wentworth Golf Club
Leachs Island
Goat Island
Shapleigh
Sheafes Pt
Frost Pt
Odiornes Point
Jaffrey Point
Fort Pt
FORT CONSTITUTION
US NAVAL RES (FORT STARK)
US MIL RES (FORT DEARBORN)
South Mill Pd
North Mill Pond
Creek Area
Clarks Island
Sullivan Point
Henderson Point
Salamander Point
Fishing Island
Wood Island
Pest Island
Boatswain Hill
Goose Island
Blunts Island
Frame Pt
Lady Isle
Little Island
Four Tree Island
Bellyhack Bogs
Substation
Quarry
Portsmouth Harbor Southeast Base

LITTLE HARBOR

STATION T-1 LOCATION: Little Harbor, SW breakwater LAT. 43° 03.3' LONG. 70° 43.0'

DATE	TIME	TIDE(-1:)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	09:56	+ 3:19	35	1,100	460	< 30	Shore station
Feb 02	09:31	+ 2:51	32	460	240	40	
Mar 09	11:23	- 0:25	39	93	15	< 30	
Apr 06	10:32	+ 0:32	41	4,600	1,500	430	
May 11	15:24	+ 0:10	51	9	< 3	< 30	
Jun 22	14:22	+ 0:18	60	9	4	< 30	
Jul 20	12:56	+ 0:08	65	9	9	< 30	
Aug 31	10:06	+ 0:42	60	75	75	40	
Sep 21	16:08	+ 0:18	60	2,400	1,100	430	
Oct 05	15:30	+ 0:17	52	750	21	< 30	
Nov 02	13:47	+ 0:43	50	28	11	< 30	
Dec 07	06:53	+ 2:02	36	240	93	40	
			Log Average (12)	104	< 41	< 50	

STATION T-6 LOCATION: Witch Creek at Sheafe's Pt. LAT. 43° 03.2 LONG. 70° 43.8'

DATE	TIME	TIDE(-1:)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	09:20	+ 2:43	35	1,500	460	150	Shore station
Feb 02	08:55	+ 2:15	31	1,100	460	150	
Mar 09	11:58	+ 0:10	41	240	9	< 30	
Apr 06	11:10	+ 1:10	43	2,400	460	230	
May 11	15:01	- 0:13	59	23	4	< 30	
Jun 22	13:43	- 0:21	60	15	7	< 30	
Jul 20	13:36	+ 0:48	72	4	4	40	
Aug 31	11:07	+ 1:43	67	9	< 3	< 3	
Sep 21	15:37	- 0:13	61	4,600	2,400	2,400	
Oct 05	14:52	- 0:21	51	240	43	40	
Nov 02	13:20	+ 0:16	51	21	11	< 30	
Dec 07	08:43	+ 3:52	38	430	93	230	
			Log Average (12)	149	< 42	< 69	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

STATION T-13 LOCATION: Bridge, Newcastle I. LAT. 43° 03.5 LONG. 70° 44.6'

DATE	TIME	TIDE(-1:)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	09:06	+ 2:29	36	1,500	1,500	150	Shore station
Feb 12	08:38	+ 1:58	33	1,100	1,100	230	
Mar 09	12:25	+ 0:37	40	1,100	460	< 30	
Apr 06	11:25	+ 1:25	43	4,600	2,400	930	
May 11	14:50	- 0:24	51	93	15	< 30	
Jun 22	13:33	- 0:31	60	240	4	< 30	
Jul 20	13:55	+ 1:07	67	4	< 3	90	
Aug 31	11:20	+ 1:56	60	240	23	< 30	
Sep 21	15:20	- 0:30	60	2,400	240	90	
Oct 05	14:37	- 0:36	50	93	43	< 30	
Nov 02	13:09	+ 0:05	49	4	< 30	< 30	
Dec 07	08:47	+ 3:56	38	240	43	40	
			Log Average (12)	270	< 82	< 67	

STATION T-8 LOCATION: Sagamore Ck, Mike's Marina LAT. 43° 03.2 LONG. 70° 44.

DATE	TIME	TIDE(-1:)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	09:32	+ 2:55	35	4,600	1,100	230	Shore station
Feb 02	09:09	+ 2:29	31	3,900	1,100	150	
Mar 09	11:45	- 0:03	41	1,500	460	< 30	
Apr 06	10:57	+ 0:57	42	1,100	460	2,400	
May 11	15:11	- 0:03	56	93	21	< 30	
Jun 22	13:56	- 0:08	63	150	93	< 30	
Jul 20	13:21	+ 0:33	69	9	9	930	
Aug 31	10:54	+ 1:30	61	240	43	40	
Sep 21	15:53	+ 0:03	60	11,000	1,100	930	
Oct 05	15:07	- 0:06	48	75	43	< 30	
Nov 02	13:31	+ 0:27	49	93	11	< 30	
Dec 07	08:17	+ 3:26	37	930	240	40	
			Log Average (12)	447	130	< 109	

STATION T-5 LOCATION: North Channel, Goat I. Bridge LAT. 43° 04.2 LONG. 70° 44.3

DATE	TIME	TIDE(+15)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	08:51	+ 0:59	35	1,100	460	< 30	Shore station
Feb 02	08:25	+ 0:30	33	1,100	460	90	
Mar 09	12:36	- 0:27	37	1,100	150	< 30	
Apr 06	11:39	+ 0:24	43	11.000	460	90	
May 11	14:39	- 1:50	51	93	43	< 30	
Jun 22	13:20	- 1:59	59	43	4	< 30	
Jul 20	14:09	+ 0:06	65	240	43	< 30	
Aug 31	11:32	+ 0:53	60	4,600	1,500	30	
Sep 21	15:01	- 2:04	60	4,600	1,100	90	
Oct 05	14:22	+ 2:06	51	240	15	< 30	
Nov 02	12:58	- 1:21	50	460	43	< 30	
Dec 07	08:58	+ 2:52	37	930	430	70	
			Log Average (12)	644	138	< 42	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

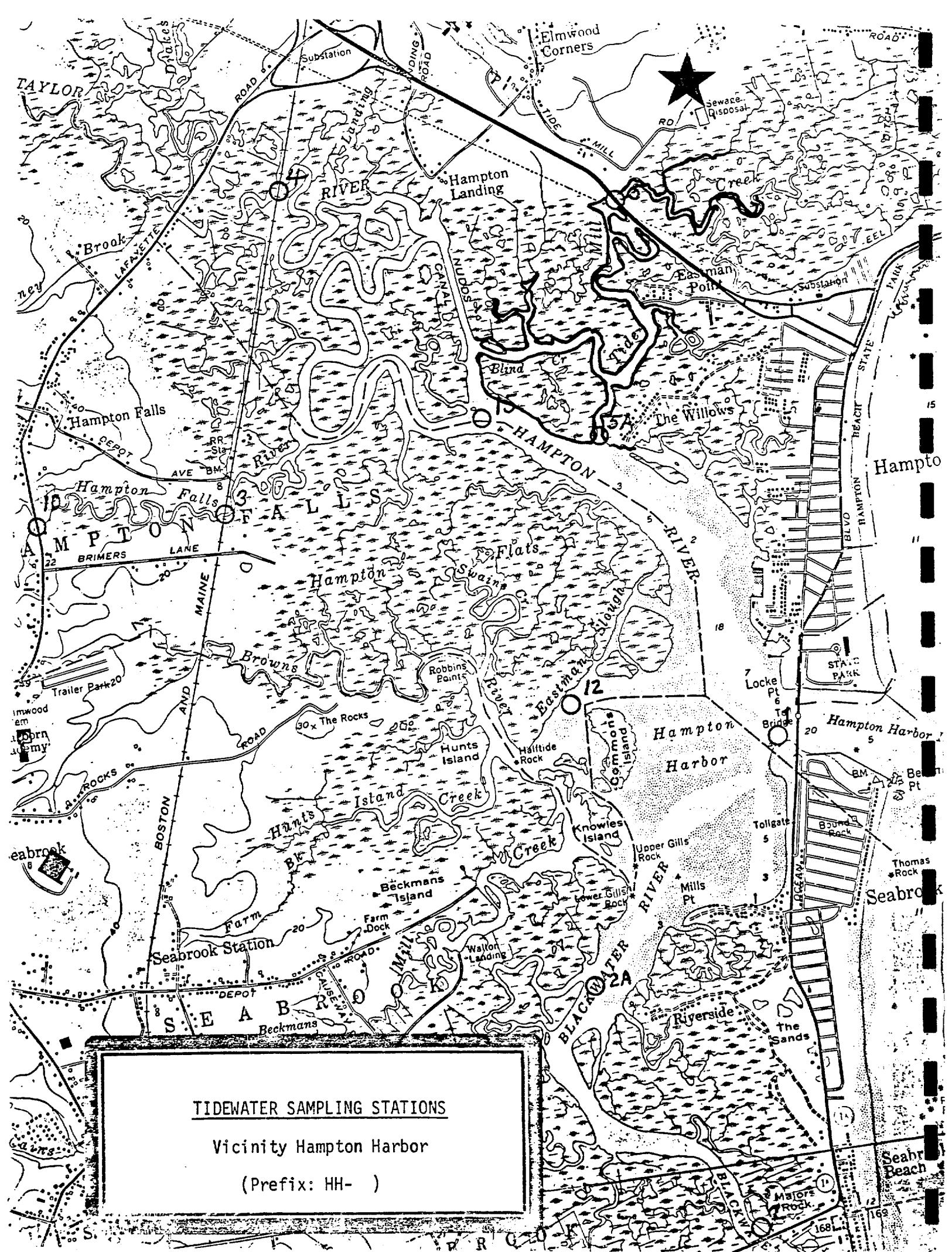
STATION T-9 LOCATION: Shapleigh I. Bridge LAT. 43° 04.3 LONG. 70° 44.6'

DATE	TIME	TIDE(+30)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	08:43	+ 0:36	36	2,400	2,400	930	Shore station
Feb 02	08:17	+ 0:07	34	2,400	1,100	230	
Mar 09	12:44	- 0:34	39	15,000	11,000	230	
Apr 06	11:48	+ 0:18	43	46,000	24,000	24,000	
May 11	14:31	- 2:13	52	2,400	240	30	
Jun 22	13:13	- 2:21	59	240	240	150	
Jul 20	14:18	0:00	66	460	240	70	
Aug 31	11:45	+ 0:49	60	1,100	460	< 30	
Sep 21	15:08	- 2:12	61	1,100	460	40	
Oct 05	14:12	- 2:31	51	460	460	430	
Nov 02	12:50	- 1:44	50	460	240	< 30	
Dec 07	09:04	+ 2:43	39	1,500	240	150	
			Log Average (12)	1,649	784	< 176	

STATION T-10 LOCATION: Pierces I. Bridge LAT. 43° 04.4 LONG. 70° 45.1'

DATE	TIME	TIDE(+30)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 19	08:31	+ 0:24	35	110,000	110,000	46,000	Shore station
Feb 02	08:04	- 0:06	34	24,000	24,000	4,600	
Mar 09	12:53	- 0:25	39	>240,000	46,000	11,000	
Apr 06	11:58	+ 0:28	43	11,000	2,400	230	
May 11	14:20	- 2:24	48	2,400	1,100	230	
Jun 22	13:02	- 2:32	59	460	460	90	
Jul 20	14:27	+ 0:09	64	4,600	460	150	
Aug 31	11:53	+ 0:59	60	460	460	< 30	
Sep 21	14:47	- 2:33	60	1,500	460	430	
Oct 05	13:57	- 2:46	50	700	150	< 30	
Nov 02	12:38	- 1:26	48	2,400	2,400	< 30	
Dec 07	09:10	+ 2:49	40	430	430	40	
			Log Average (12)	> 4,017	1,901	< 309	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.



TIDEWATER SAMPLING STATIONS

Vicinity Hampton Harbor

(Prefix: HH-)

HAMPTON HARBOR

STATION HH-1 LOCATION: S. shore, just inside bridge LAT. 42° 53.7 LONG. 70° 49.1'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	12:53	- 1:09	32	15	15	40	Shore sample
Feb 23	12:37	- 0:03	32	43	9	40	" "
Mar 23	11:16	- 0:05	40	43	43	< 30	" "
Apr 20	11:35	+ 1:35	48	93	23	< 30	Boat run
May 04	11:08	+ 0:40	48	43	23	< 30	" "
Jun 08	14:30	- 0:16	59	75	43	< 30	" "
Jul 06	13:31	+ 0:17	71	150	3	< 30	" "
Dec 28	10:45	- 0:39	37	4	4	< 30	Shore sample
		Log Average	(8)	20	15	< 32	

STATION HH-1A LOCATION: Under Rte 1A bridge(Coastal 1) LAT. 42° 53.7 LONG. 70° 49.1'

DATE	TIME	TIDE(+05)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Aug 17	12:47	+ 0:33	68	43	23	< 30	Boat station
Sep 14	11:33	+ 0:49	63	4,600	1,100	430	
Oct 19	14:01	- 1:40	51	7	7	< 30	
Nov 30	12:47	+ 0:02	43	75	9	230	
		Log Average	(4)	101	33	< 97	

STATION HH-2 LOCATION: Blackwater R, Rte 286 bridge LAT. 42° 52.3 LONG. 70° 49.5'

DATE	TIME	TIDE(+10)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	13:10	- 1:02	31	150	23	40	Shore station
Feb 23	12:20	- 0:31	31	93	23	< 30	
Mar 23	11:27	- 0:04	41	93	43	< 30	
May 04	11:42	+ 1:04	52	11,000	43	< 30	
Dec 28	13:58	+ 2:24	35	93	4	40	
		Log Average	(5)	266	21	< 34	

STATION HH-2A LOCATION: Blackwater R, vic Riverside LAT. 42° 53.1 LONG. 70° 50.0'

DATE	TIME	TIDE(+05)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Apr 20	11:29	+ 1:24	48	240	7	< 30	Boat station
May 04	11:04	+ 0:30	50	460	43	< 30	
Jun 08	14:26	- 0:25	63	93	93	< 30	
Jul 06	13:26	+ 0:07	73	75	23	< 30	
Aug 17	12:42	+ 0:28	75	240	23	< 30	
Sep 14	11:28	+ 0:44	66	1,500	1,500	2,400	
Oct 19	13:53	- 1:48	51	15	15	< 30	
Nov 30	12:43	- 0:02	43	93	43	90	
		Log Average	(8)	156	44	< 59	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

STATION HH-3 LOCATION: Hampton Falls R, RR bridge LAT. 42° 54.6 LONG. 70° 51.2'

DATE	TIME	TIDE(+10)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	13:22	- 0:50	31	750	460	90	Shore station
Feb 23	11:45	- 1:06	32	2,400	9	40	
Jun 01	11:32	+ 2:11	78	1,100	-	-	
Dec 28	11:15	- 0:19	33	930	9	40	
			Log Average (4)	156	(3) 33	(3) 52	

STATION HH-4 LOCATION: Taylor R, RR bridge LAT. 42° 55.5 LONG. 70° 50.8'

DATE	TIME	TIDE(+10)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	13:54	- 0:18	31	240	23	40	Shore station
Feb 23	10:20	- 2:31	31	23	< 3	< 30	
Apr 20	12:01	+ 1:51	52	750	43	90	
Dec 28	11:31	- 0:03	33	930	4	150	
			Log Average (4)	249	< 17	< 63	

STATION HH-5 LOCATION: Tide Mill Ck, Rte 51 bridge LAT. 42° 55.3 LONG. 70° 49.4'

DATE	TIME	TIDE(+10)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	14:18	+ 0:06	31	460	21	40	Shore station
Feb 23	10:57	- 1:54	31	43	23	430	
Mar 23	12:39	+ 1:08	40	240	240	230	
Dec 28	11:43	+ 0:09	33	150	23	7,500	
			Log Average (4)	163	40	415	

STATION HH-5A LOCATION: Tide Mill Ck, mouth LAT. 42° 54.7 LONG. 70° 49.7'

DATE	TIME	TIDE(+05)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	14:40	- 0:33	30	150	39	90	Boat station
Apr 20	11:11	+ 1:06	49	240	< 30	< 30	
May 04	10:53	+ 0:20	50	460	15	< 30	
Jun 08	14:15	- 0:36	63	43	15	< 30	
Jul 06	13:14	- 0:05	73	150	43	< 30	
Aug 17	12:31	+ 0:17	74	240	240	150	
Sep 14	11:16	+ 0:32	65	11,000	1,100	2,400	
Oct 19	13:41	- 2:00	51	11	11	< 30	
Nov 30	12:32	- 0:23	43	93	23	930	
			Log Average (9)	188	< 45	< 97	

STATION HH-11 LOCATION: Hampton Falls R, Rte 84 bridge LAT. 42° 54.6 LONG. 70° 53.0'

DATE	TIME	TIDE(N/A)	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Aug 03	11:42		63	11,000	-	-	Shore station

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

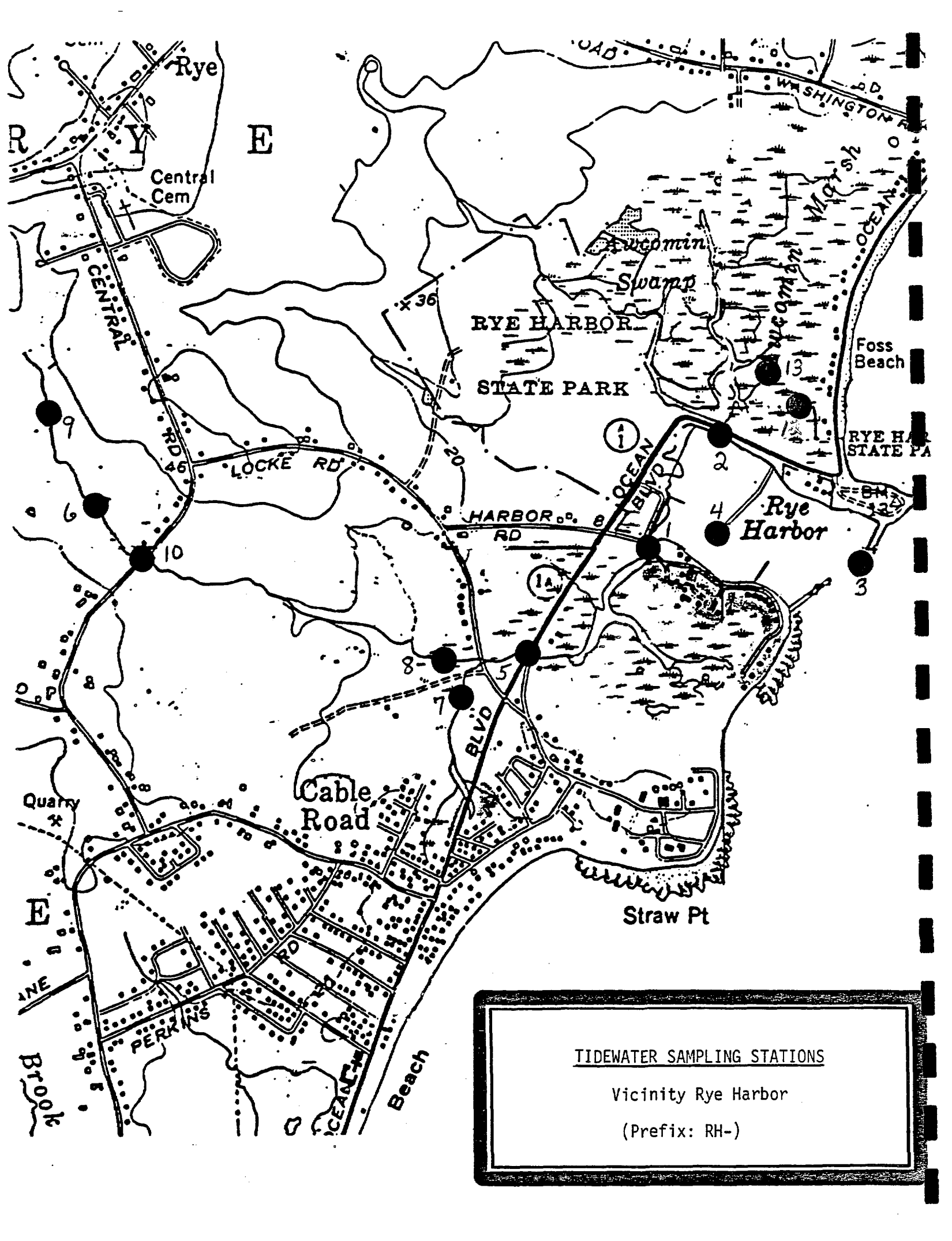
STATION HH-12 LOCATION: Eastman Slough, vic Common's I LAT. 42° 53.9 LONG. 70° 49.9

DATE	TIME	TIDE(+05)*	TEMP(°F)	COLIFORM(MPN/100mL)) TOTAL	FECAL	STREP	FECAL REMARKS
Apr 20	11:17	+ 1:12	49	93	9	< 30	Boat station
May 04	10:58	+ 0:25	49	9	4	< 30	
Jun 08	14:20	- 0:31	63	11	7	< 30	
Jul 06	13:19	0:00	73	4	4	< 30	
Aug 17	12:36	+ 0:22	73	4	4	< 30	
Sep 14	11:21	+ 0:37	65	11,000	4,600	2,400	
Oct 19	13:48	- 1:53	51	39	23	40	
Nov 30	12:37	- 0:18	43	23	9	150	
		Log Average	(8)	33	16	< 66	

STATION HH-15 LOCATION: Hampton Falls R / Nudds Canal LAT. 42° 54.8 LONG. 70° 50.1

DATE	TIME	TIDE(+10)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Apr 20	11:15	+ 1:05	49	430	11	< 30	Boat station
May 04	10:50	+ 0:12	50	240	9	< 30	
Jun 08	14:12	- 0:44	64	21	9	< 30	
Jul 06	13:10	- 0:14	72	23	9	< 30	
Aug 17	12:28	+ 0:09	75	9	9	< 30	
Sep 14	11:13	+ 0:24	66	1,500	240	230	
Oct 19	13:31	- 2:15	51	43	43	< 30	
Nov 30	12:29	- 0:31	43	930	9	40	
		Log Average	(8)	113	17	< 40	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.



TIDEWATER SAMPLING STATIONS

Vicinity Rye Harbor

(Prefix: RH-)

RYE HARBOR

STATION RH-1 LOCATION: Unnamed est, Harbor Rd bridge LAT. 43° 00.0' LONG. 70° 45.2'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	12:00	- 2:02	30	460	460	40	Shore station
Feb 23	11:03	- 1:38	32	2,400	43	150	
Mar 23	09:23	- 1:58	40	240	93	< 30	
Apr 20	10:38	+ 0:38	51	230	240	40	
May 04	09:57	- 0:31	48	1,500	43	90	
Jun 08	13:23	- 1:23	64	1,100	93	40	
Jun 17	10:00	- 0:27	--	1,500	23	90	Sp. Study
Jul 06	13:25	+ 0:11	81	930	93	< 30	
Jul 07	12:06	- 2:02	--	140	43	< 30	Sp. Study
Aug 17	11:26	- 0:43	74	43	43	150	
Sep 14	10:26	- 0:13	66	240,000	46,000	11,000	
Oct 19	13:02	- 2:34	52	240	43	40	
Nov 30	13:28	+ 0:38	43	15,000	430	9,300	
Dec 28	09:44	- 1:40	34	230	150	1,500	
			Log Average (14)	880	138	< 146	

STATION RH-2 LOCATION: Outlet, Awcomin Marsh, Rte 1A LAT. 43° 00.2' LONG. 70° 45.0'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	12:07	- 1:55	30	93	< 3	< 30	Shore station
Mar 23	09:30	- 1:51	40	150	4	< 30	
Apr 20	10:31	+ 0:31	50	390	< 30	< 30	
May 04	09:47	- 0:41	47	4	< 3	< 30	
Jun 08	13:30	- 1:16	64	21	43	< 30	
Jun 17	10:30	+ 0:03	--	43	43	< 30	Sp. Study
Jul 06	13:40	+ 0:26	71	240	9	< 30	
Jul 07	12:32	- 1:36	--	230	43	40	Sp. Study
Aug 17	11:20	- 0:49	73	93	9	< 30	
Sep 14	10:17	- 0:22	64	24,000	11,000	4,600	
Oct 19	12:49	- 2:47	51	4	< 3	< 30	
Nov 30	13:32	+ 0:42	44	1,500	43	70	
Dec 28	09:50	- 1:34	33	150	93	< 30	
			Log Average (13)	127	< 24	< 48	

STATION RH-3 LOCATION: End of N. breakwater, inshore LAT. 43° 00.0' LONG. 70° 44.7'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Feb 23	13:46	+ 1:05	33	< 3	< 3	< 30	Shore station
Mar 23	09:43	- 1:38	40	240	240	< 30	
Sep 14	10:08	- 0:31	63	46,000	7,500	930	
Dec 28	10:13	- 1:11	38	< 3	< 3	< 30	
			Log Average (4)	< 100	< 63	< 71	

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

STATION RH-4 LOCATION: End of inner breakwater(mole) LAT. 43° 00.1' LONG. 70° 45.0'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jan 26	11:25	- 2:37	30	23	23	40	Shore station
Feb 23	13:18	+ 0:37	34	23	23	< 30	
Mar 23	10:01	- 1:20	40	93	93	< 30	
Apr 20	10:21	+ 0:21	49	23	9	< 30	
May 04	09:40	- 0:48	45	15	4	< 30	
Jun 08	13:36	- 1:10	62	43	15	< 30	
Jul 06	13:35	+ 0:21	72	93	11	< 30	
Aug 17	11:12	- 0:57	71	43	23	< 30	
Sep 14	09:58	- 0:41	64	24,000	1,100	4,600	
Oct 19	12:46	- 2:50	51	9	9	430	
Nov 30	13:42	+ 0:56	44	4,300	93	430	
Dec 28	10:02	- 1:22	35	230	23	40	
			Log Average (12)	96	25	< 75	

STATION RH-5 LOCATION: Unnamed est, Rte 1A bridge LAT. 42° 59.8' LONG. 70° 45.4'

DATE	TIME	TIDE(0+0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 17	10:12	- 0:15	-	11,000	460	430	Sp. Study

STATION RH-7 LOCATION: Unnamed trib to 5, W of Rte 1A LAT. 42° 59.7' LONG. 70° 45.7'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 17	10:17	- 0:10	-	7,500	1,100	230	Sp. Study

STATION RH-8 LOCATION: Unnamed est, W of Locke Rd LAT. 42° 59.8' LONG. 70° 45.8'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 17	10:19	- 0:08	-	11,000	1,100	430	Sp. Study
Jul 07	11:48	- 2:20	-	11,000	1,100	230	" "
			Log Average (2)	11,000	1,100	< 314	

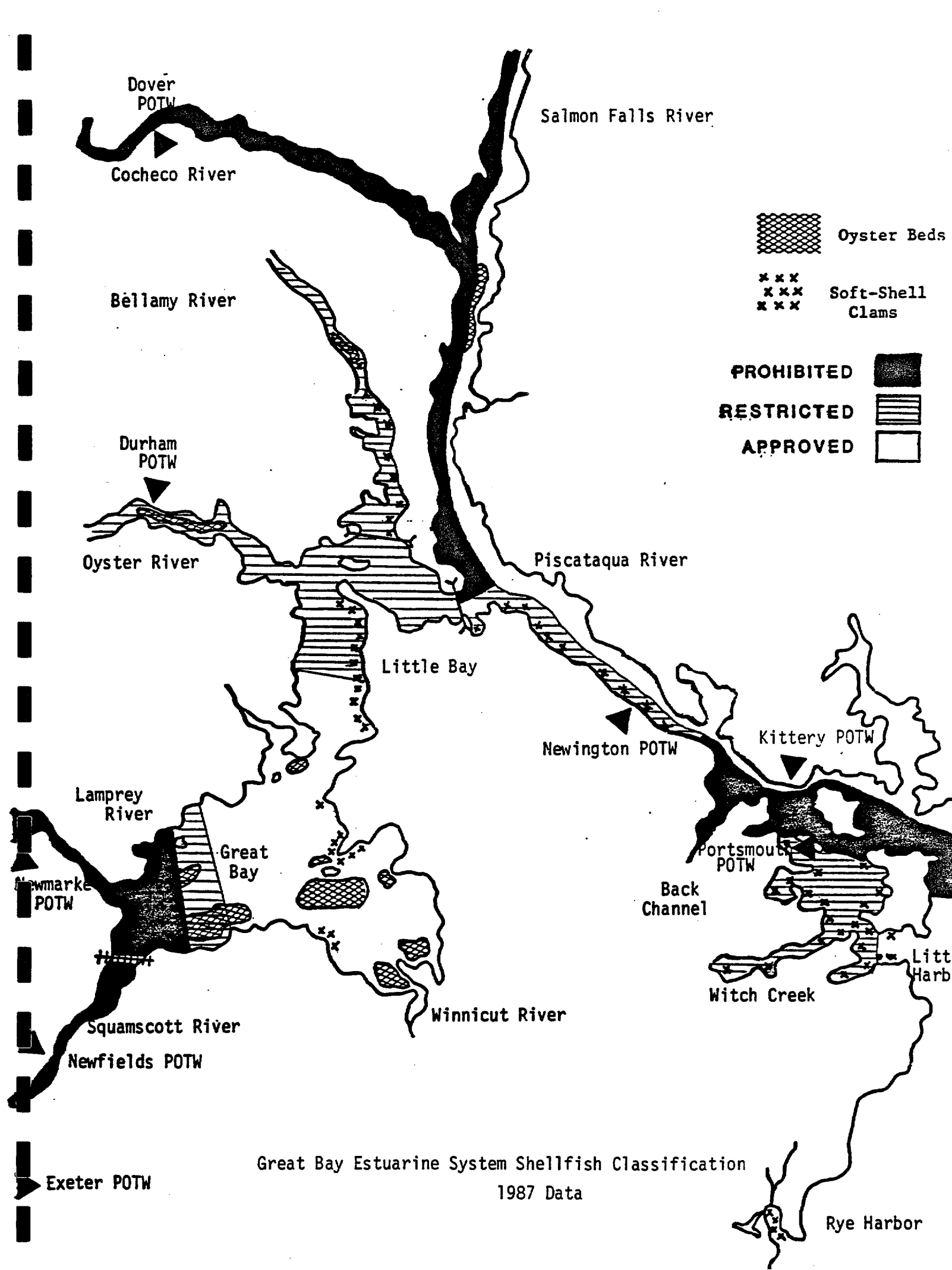
STATION RH-12 LOCATION: Unnamed str, Awcomin Marsh LAT. 43° 00.3' LONG. 70° 44.8'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 17	09:20	- 1:07	-	390	43	40	Sp. Study
Jul 07	12:20	- 1:48	-	4,600	1,500	40	" "
			Log Average (2)	1,339	254	40	

STATION RH-13 LOCATION: Unnamed str, Awcomin Marsh LAT. 43° 00.3' LONG. 70° 44.8'

DATE	TIME	TIDE(0:0)*	TEMP(°F)	COLIFORM(MPN/100mL) TOTAL	FECAL	FECAL STREP	REMARKS
Jun 17	09:18	- 1:09	--	75	43	90	Sp. Study

* Correction for low tide at location; from NOAA Current Tables, on Portland, ME
TIDE Data entries are time from low tide at location.

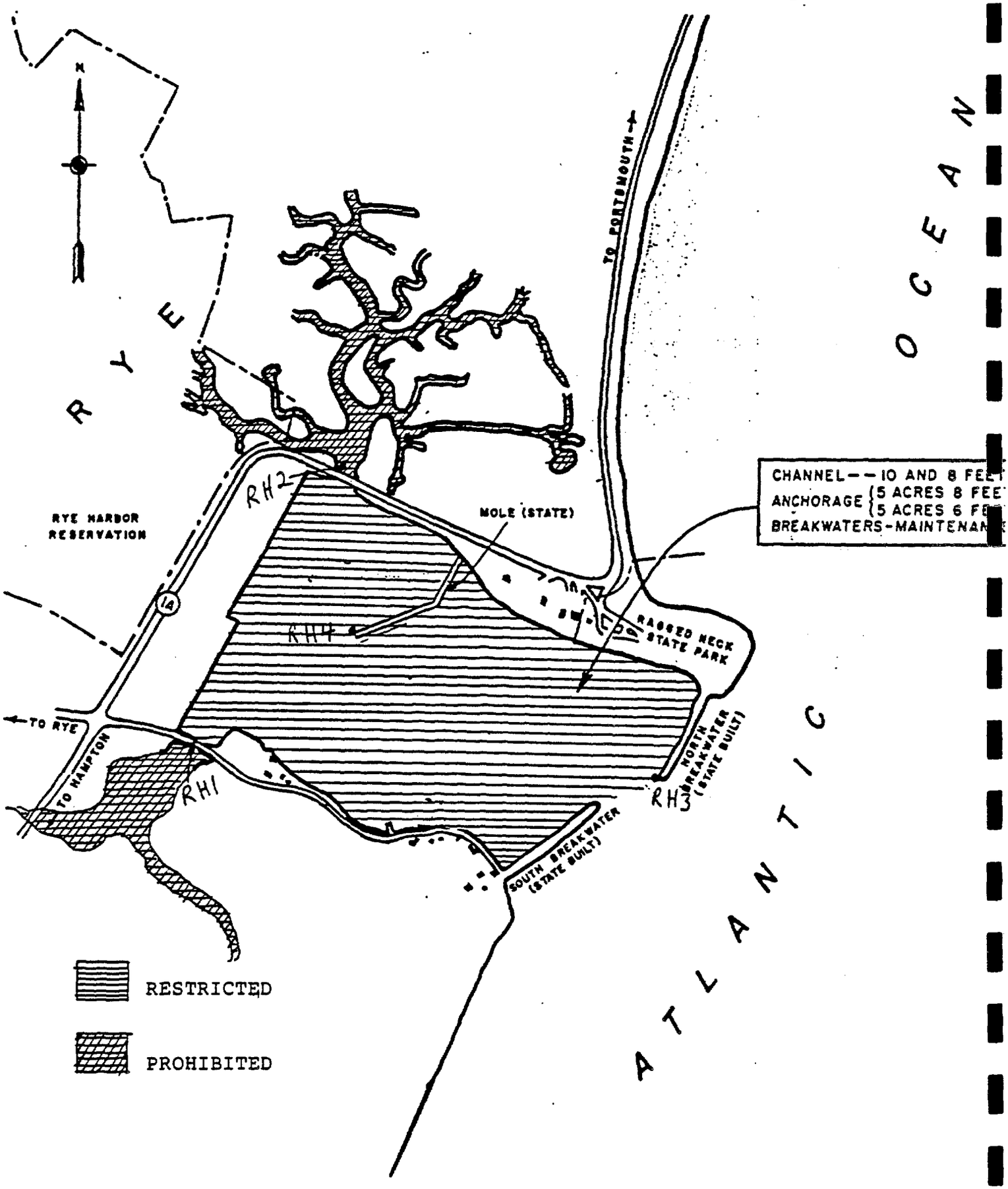


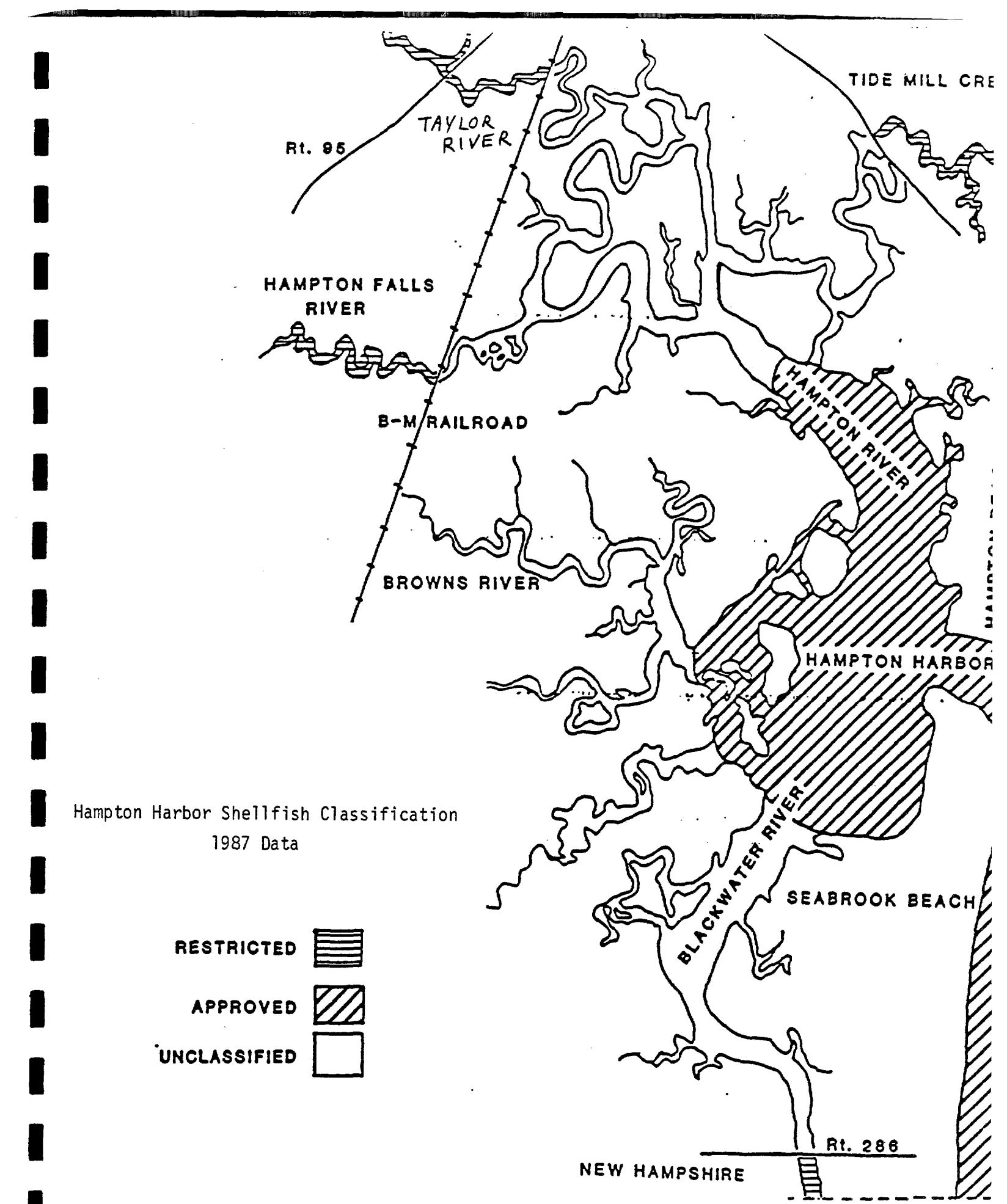
Great Bay Estuarine System Shellfish Classification
1987 Data

Rye Harbor Shellfish Classification

1987 Data

CORPS OF ENGINEERS





Hampton Harbor Shellfish Classification
1987 Data

APPENDIX VII

RESPONSIVENESS SUMMARY

INTRODUCTION

Following the review and discussion of the Draft Interagency Report on the Shellfish Waters of New Hampshire, the Water Supply & Pollution Control Council agreed at its October 12, 1988 meeting to present this report to Commissioner Alden H. Howard for final review and subsequent transmittal to CORD. Final report review was provided by three groups:

a) Review and comment by the Interagency Shellfish Committee members.
b) Review and comment by the Office of the Assistant Commissioner and,
c) Review and comment by a Peer Review panel, made up of representatives of UNH (Dr. Raymond Grizzle of the Jackson Estuarine Laboratory), Water Resources Division (Dr. Frank Richardson), Water Supply Bureau of WS&PCD (Robert Mann, P.E.), and the Office of State Planning (Stephanie D'Agostino of the Coastal Zone Program).

This Appendix will focus on comments offered by the Peer Review panel.

To accomplish Peer Review, Gordon Page, P.E., (of the Public Information and Permits Office of DES) solicited participation of panel members and invited them to attend a scoping session held at DES offices on December 9, 1988. All members except Dr. Richardson were able to attend. Also present was the report author, Richard A. Flanders, Jr., and Jay Berry of the Waste Management Bureau. Mr. Page overviewed the process to be followed by the reviewers and Mr. Berry described how Peer Review had resulted in valuable input to an asbestos report he had authored. Mr. Flanders explained that his role was to bring together the views of the three Shellfish Committee members and draft a concensus report. It was agreed that all panelists would comment directly on one master copy of the report, which was to be circulated.

Separate written comments were submitted by Dr. Grizzle dated January 4, 1989 (see attached). The other panelists' comments were written on the master copy. Minor punctuation changes will not be discussed here. A Responsiveness Summary that addresses Peer Review input follows.

Page	Question or Comment	Response
1	Abbreviations for agencies should be spelled out.	Done
2&29	Alternatives to use of chlorine should be addressed. While mentioned on page 5 of the Recommendations Section, such alternatives are highlighted by addition of text in this Section.	Done
3	Swamps as bacteria source questioned. Reference to swamps was deleted; urban runoff as source of coliforms was added.	Change Made
4	Question raised as to how the size of restricted shellfish zones near POTW outfalls would be determined. This would have to be determined later and was not considered to be in the scope of this report.	N/A
5	Suggestion was made to change "tens of millions of dollars" to "substantial investment".	No Change Made
6	Comment was made that an additional benefit of a cost/ benefit analysis would be in allowing prioritization of areas to be remediated. Text change made to include this point.	Change Made

N/A -Not Applicable

Page	Question or Comment	Response
7	Comment was made that the EPA waiver of the requirement to provide secondary treatment at Portsmouth was not noted. Text change was made to refer to additional upgrade at Portsmouth without reference to secondary level of treatment.	Change Made
8	Recommendation was made to include a definition of MPN and perhaps a definitions section in report. MPN was spelled out; Appendix II provides definitions.	Done
8	Qualifying phrase "at the same time" suggested prior to "protecting the receiving waters from chlorine toxicity".	Done
8	Comment made that all of Exter's storm and sanitary sewers are not yet separated. Comment added to text to make this point.	Change Made
9	Definition for "restricted" and "prohibited" suggested. Reference to definition in Appendix II added.	Done
10	Piscassic River does not drain to Great Bay; Winnicut River should be added.	Done
18	Comment made that approach used in Rye Harbor be considered for the Rye Beach-Rye Ledge area (soil suitability criteria rather than sewers). This would reduce the environmental impact of chlorine at a new point source.	Comment Noted
19	Comment made that Figure 5 shading for the Piscataqua River is not explained. A key was added to do this.	Done
23	A comment was made that a map of the location of all wastewater treatment facilities would be helpful. Locations were added to Figures 1 and 2.	Done
27	A number of comments on the Newmarket POTW equipment capabilities following its recent upgrade were offered. Operations Section feels summary is accurate.	No Changes Made
29	Comment was made that other valuable resources exist in the estuary than just shellfish and should be factored into any cost/benefit analysis. Additional resource values added to text.	Change Made
29	Comment was made that there was too much emphasis on chlorination evaluations without discussing alternative disinfection options. Text was modified to recommend study of alternatives.	Change Made
29	Comment was made that the importance of dechlorination was not emphasized in the Executive Summary. Page 5 of the Executive Summary did reference dechlorination.	No Change Made

Comments in Dr. Grizzle's letter:

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2	Comment was made that overall goal of reopening shellfish beds for harvesting is desirable, and suggests that the state should explore establishment of a commercial industry. Such a recommendation is outside of the scope of this report.
2&3	Comment was made that if the goal was simply to improve water quality to attain the "approved" classification of shellfish waters, and such a goal was not attainable, "no action" was not an acceptable end point. (Other benefits than derived merely from shellfish harvesting warrant working toward water quality improvements). The focus of the report was to highlight potential water quality improvements that could be achieved by, initially, looking at possible improvements in POTW's, and, later, at potential remaining nonpoint pollution sources. This focus on point sources is a given: all such facilities must comply with their NPDES permit limitations for coliforms and other parameters. In addition to being shellfish waters, all of the estuarine waters are Class B, and must be fishable and swimmable. In no way will the other benefits of water quality improvements be ignored.
3	The comment was made that some attempt should be made to estimate the relative importance of point versus nonpoint sources of bacteria. As noted in the Executive Summary and text of the report, further study to identify nonpoint sources is warranted. We would support any UNH research in this area.
3&4	Comment was made that the cost/benefit approach not be focused only on the value of the shellfishery. Comment so noted and added to text as noted above.
4	Comment was made that due to the continuity of Great Bay and Piscataqua River waters, pollution sources including Portsmouth and Maine discharges must be factored into any comprehensive analysis. The report clearly states that the initial emphasis would be placed on non-Piscataqua River sources due to masking effects of known high bacterial discharges into these waters. Subsequent emphasis on these waters must, and will, follow upgradings of key facilities.
5	Comment is made that heavily fished oyster beds in the Adams Point area were not shown in Figure 1. Comment noted; an attempt to update this figure will be made.
5	Comment was made that site specific problems for Great and Little Bays were not shown on any map. POTW locations will be added to Figures 1 and 2.

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5 Comment was made that water quality problems "should be the sole concern of the state" and not thrust onto the towns.

The municipalities hold the NPDES permits for any POTW's discharging to surface waters; they are responsible for meeting permit limitations. Town Selectmen or designated Health Officers have requisite local authority to address pollution. The Operations Section of WS&PCD provides technical support to towns to assist in pollution abatement. The state and federal government may take enforcement action against towns for violating water quality standards.

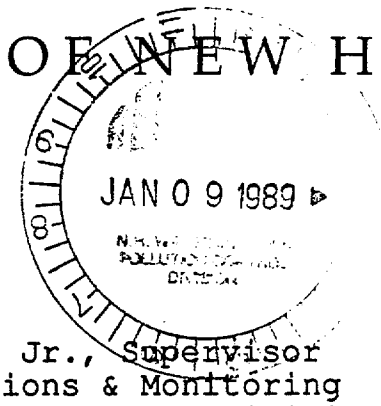
In addition, George Neill, P.E. of the Operations Section of WS&PCD points out (see attached memo) that POTW operators and towns do take seriously their charge to address pollution. As he notes, several facilities have made equipment purchases or modifications or have changed procedures in response to bacterial reduction concerns over the last year. Cooperative approaches-working with towns in a positive rather than adversarial fashion-will continue to offer a cost effective alternative to enforcement actions by the state or federal government.

5 Comment was made that there is no mention in the report of the possible impact of industrial wastes, pesticides, or radionuclides in shellfish waters.

The report focuses exclusively on coliform bacteria problems, not on the additional sources mentioned. Monitoring of industrial discharges is provided via NPDES permits. Public Health (Risk Assessment Bureau), the Pesticides Control Board, and other state agencies have additional information on the presence of other potentially toxic materials.

UNIVERSITY OF NEW HAMPSHIRE

Jackson Estuarine Laboratory
Adams Point
R.F.D. 2
Durham, New Hampshire 03824
(603) 862-2175



January 4, 1989

Mr. Richard A. Flanders, Jr., Supervisor
Water Quality Investigations & Monitoring
Water Supply and Pollution Control Division
N.H. Department of Environmental Services
P.O. Box 95
Concord, NH 03301

Dear Dick:

This letter contains our comments on your "Interagency Report on the Shellfish Waters of New Hampshire." I indicated at our meeting here at Jackson Estuarine Laboratory (JEL) that because of the interest among our staff in the report and the desire of several individuals to comment on it, I would probably just send the 'master copy' to Dr. Frank Richardson with only minor editorial comments. This has been done.

The first part of this letter is an expansion on some of our staff's statements, but its contents are primarily my own opinions. I have also listed at the end of the letter several comments from our staff that should be considered for your final draft.

Overall we were quite pleased with the report. Because many of us at JEL have a real concern for water quality issues in New Hampshire we are particularly happy to be able to contribute in some way to your ongoing efforts in pollution control.

With respect to content, the report was well written and well organized. The material in the appendices particularly provided good support for, and explanation of, various aspects of the report. Such a compilation of information including an explanation of how the three management agencies are related has value in itself, especially to those outside of the regulatory agencies but interested in their activities. I was glad to see this documentation.

However, I have some concerns about several topics in the report. To begin, I will summarize some of the major points of the report, and then comment on them.

The report makes the following points. The main objective of the report was to point the way for achieving "...the goal of reopening shellfish beds..."(p. 5). To best proceed toward

this objective it was suggested that initial attention be focused on those shellfish waters that show the most promise for being cleaned up (p. 1), and that initial efforts be directed toward improvements in existing Publicly Owned Treatment Works (POTWs) (pp. 3-4), some of which at times may not be in compliance with their NPDES permits. It was recognized that the contribution of nonpoint sources of pollution relative to point sources (POTWs) remains undetermined in virtually all areas, and should be assessed (pp. 4, 30, 32). It is thus possible that even if the targeted POTWs are brought into compliance, the nonpoint loadings would be sufficient to warrant continued closure of some shellfish areas some of the time (p. 4). It was suggested that in general there will always be designated "prohibited" zones around POTW outfalls because of the potential for increased pollutant loadings sporadically; e.g., when there are malfunctions at the POTW, or during heavy rain events in those areas served by combined sewers (pp. 3-4). Finally, it was suggested that a cost (to improve water quality)/benefit (money derived from shellfish harvesting) approach be used to decide what action should be taken. I would like to briefly comment on several of these points.

The overall goal of reopening shellfish beds for harvesting certainly seems to be a desirable objective. If this goal includes a thorough investigation of various measures designed to manage shellfish relative to existing water quality conditions and monitoring capabilities, enforcement capabilities, and other constraints, then I totally agree with the goal. By this I mean that the State should explore a wide range of possibilities including: re-classification of some areas to "restricted" status, and active management of these areas; encourage establishment of a commercial industry in New Hampshire that includes relaying and/or depuration operations, perhaps in cooperation with industry and management people in Maine; and other options pursued by those in other states (e.g., Connecticut) where water quality problems have drastically affected shellfish management. However, if the above overall goal simply means that the possibility of bringing water quality levels into compliance for an "approved" classification is to be explored, then I do not agree with this as an overall goal. I say this primarily because if it was found <u>not</u> to be an attainable goal it might mean that efforts to improve water quality in shellfish waters would be curtailed. I don't believe this would be beneficial to the citizens of the State of New Hampshire, regardless of their interest in shellfish.

The suggestion that initially attention should be focused on shellfish waters most likely to be improved, and that the

major efforts should be directed toward POTWs, seem to me to be reasonable approaches. In fact, I would think that if there are POTWs seriously out of compliance with their NPDES permits such action would be routine. I am, however, aware of some of the difficulties associated with everyday operation of POTWs and the myriad of problems that sporadically affect their performance, as well as the practical difficulties involved in enforcement. I think that improvement of the operation of POTWs would always be a desirable objective, regardless of the potential impact on shellfish waters. Nonetheless, I think that actions aimed at improvement of the performance of POTWs should not solely depend on whether or not the goal of reopening shellfish beds is achieved. In particular, it might be detrimental in the long run with respect to enforcement to predicate expenditures for POTW improvements on the premise that they were mainly for achieving the goal of reopening shellfish waters, if the reopenings did not occur because water quality was not sufficiently improved.

Directly related to the above topic is the possibility that nonpoint loadings in some areas might result in improvements at POTWs having no significance with respect to reopening some shellfish waters. I think it might be useful to at least attempt to estimate the point vs. nonpoint contributions of microbial pollutants. Such an estimation of point vs. nonpoint loadings should be possible at some level of accuracy based on studies in other areas of New England with similar land uses. The level of accuracy might not be useful, but it may worth exploring. (I would be interested in knowing if you have done this already.) In any case, based on our previous conversations I think we both agree that studies on this topic, whether they consist of analyses of existing data from other areas or new studies in New Hampshire, must be done in order to best design pollution control actions.

The report also mentioned that "prohibited" zones will probably always exist around POTW outfalls. I see no way around this. Malfunctions at POTWs are always possible, and public health concerns will always require some type of a "buffer zone." This fact, however, can be used as another argument for development of relay or depuration procedures for New Hampshire. As you are well aware, such procedures have been used successfully in many areas in reaction to deteriorating water quality.

Finally, I would like to comment on the suggestion in the report that a cost/benefit approach be used to decide if POTW improvements should be pursued. I strongly disagree with this approach if the "benefit" portion will only include the value of the shellfish resource. I think that environmentalists are

generally waking up to the realities of the power of the dollar in driving most kinds of pollution control efforts. Management of shellfish waters is no exception. However, the benefits of water quality improvements in shellfish waters include far more than those accrued from shellfish revenues. I imagine that you would agree with this assessment, but unless I misinterpreted the cost/benefit suggestion, the report indicates a much narrower approach. I would like to see environmental regulatory agencies working closely with economists at every turn, and I think this will be the rule in the future. But to my knowledge this does not commonly occur now, and such input from economists should include far more than a cost/benefit assessment of a single resource.

To summarize I suggest:

1. The overall goal of reopening shellfish beds needs to be clearly defined.

2. The objective of improving the performance of POTWs should not be solely tied to the goal of reopening shellfish beds.

3. The relative contributions of point and nonpoint pollution sources must be estimated for effective management of water quality.

4. "Prohibited" zones will probably always be needed around POTW outfalls. This makes the argument for initiating relay and depuration operations more powerful if one desires to make full use of the shellfish resources in New Hampshire.

5. If the proposed cost/benefit analysis is used, then it must be based on far more than the monetary value of just the shellfish harvested.

These comments cover my major concerns with the report. The following comments are on other points raised by our staff.

p. 1. Because the entire estuarine system from Portsmouth to the streams entering Great Bay is hydraulically continuous, water quality changes in one area potentially affect others. Obviously the amount of the effect is related to distance. However, at some time the entire system must be considered, and this analysis must include pollution sources from Maine. In fact, due to the probable rapid dispersal of pollutants from the Piscataqua River into Great Bay on a flooding tide,

it may only be possible to consider some portions of the tributary streams as usefully manageable if the Piscataqua River is ignored.

p. 11. There are heavily fished oyster beds in the Adams Point area that should be shown.

Where are the maps showing site specific problems for Great and Little Bays?

Because water bodies typically impact more than one community, it seems that water quality problems should be the sole concern of the state. For example, the recommendation that "town officials identify and eliminate" possible pollution in Moonlight Brook in Newmarket (p. 20) gives no guarantee that any action will be initiated. If the state doesn't have the manpower or time to evaluate such potential pollution sources, how can small local communities be expected to shoulder the burden, and what incentive is there for them? Possibly more appropriate would be for the state or some capable alternative party funded by the state to identify important sources of pollution and require appropriate corrective action, with enforcement aided by the specific local community.

The recommendation to upgrade chlorination equipment is a good idea and will probably result in water quality improvements. However, the capacities and operation efficiencies of the targeted POTWs should also be evaluated. Without considering inevitable growth and accompanying increases in flow, 3 of the 4 POTWs impacting Great and Little Bays presently have peak flows that exceed design flow capacities. The recommendation that priority should be given to coastal communities for POTW construction money addresses this concern to some extent. However, significant, long-term solutions to water quality problems must include recognition of the need for upgrading these facilities with accompanying improvements in their operation.

No mention is made of the possible impact of any industrial wastes, pesticides, or radionuclides in shellfish waters, as required in sanitary surveys (He-P2152.01). Have these parameters been measured?

Please consider all these comments in a positive and constructive light. If we have erred from misunderstanding or ignorance, or you otherwise disagree with any of these assessments, we would welcome your comments. If we have raised some issues worth considering, then we have all benefitted. Thank you again for allowing Jackson Estuarine Laboratory to be a

part of the peer review process. I hope this will prove to be the beginning of a fruitful relationship between our institutions.

Sincerely yours,

Raymond E. Grizzle,
Research Scientist

cc: Mr. Gordon Page, Permitting Engineer, Water Supply and Pollution Control Division
Dr. Franz Anderson, Director, Jackson Estuarine Laboratory
Dr. Frank Richardson, Senior Inspector, NH Wetlands Board
Dr. Steve Jones, Research Scientist, JEL
Mr. Richard Langan, Laboratory Manager, JEL
Dr. Clayton Penniman, Research Scientist, JEL
Mr. Tom Howell, Spinney Creek Shellfish Co.

2/2/89

FROM: George C. Neill, P. E., Supervisor
Operations Section
DES/WSPCD

SUBJECT: Draft Shellfish Report

TO: Richard A. Flanders, Supervisor
Water Quality Section

Please consider the following comments regarding the subject report:

1.) P.-23. As per recommendations from Operations personnel, the Hampton POTW has installed an effluent flow meter and a 0-70 gph metering pump that doses hypochlorite proportionally to the flow. In addition, the town will be purchasing a 0-30 gph metering pump as backup that will also be flow proportional.

2.) P.-24. The dye testing of and improvements to the chlorine contact tanks at Seabrook station were performed under the guidance of the Operations Section.

3.) P.-25. The effluent from the Exeter stormwater lagoons is presently manually controlled to be discharged on the outgoing tide. The operator has been trained to do this and it is discussed in the O&M manual. Therefore, utilization of a tide clock may not be necessary.

4.) P.-27. Subsequent to discussions between this office and the facility operator, the Newmarket POTW retrofit a flow paced chlorination system with their own funds.

5.) P.-28. Durham has recently purchased and installed a flow paced hypochlorite metering pump. This was done at the urging of this office.

6.) General Comment. We have stressed to all POTWs in the areas of concern that adequate disinfection practice is imperative in order to achieve and sustain the integrity of shellfish areas and have attempted to offer technical assistance to this end. As can be seen from the above comments, POTW's apparently feel that this is important and many have already taken steps over the past year to improve their operations. We feel that pollution control facility operators are willing to cooperate and take action where possible to be more efficient.

GCN/vv

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